

THE JOURNAL OF THE BOARD OF AGRICULTURE

Vol. XXII. No. 1.

APRIL, 1915.

DRIED YEAST AS FOOD FOR FARM STOCK.

CHARLES CROWTHER, M.A., PH.D.

Department of Agriculture, University of Leeds.

THE brewing of beer from malt and hops gives rise to three by-products which are of interest to the farmer in making up rations for his stock, viz., *grains* (wet or dried), *spent hops* and *yeast* (wet, compressed or dried).

In this country the feeding of brewers' grains, especially to cows in milk, is a widespread and long-established practice, whilst in recent years the use of spent hops in the guise of various proprietary compound foods has been considerably extended. So far as the writer is aware, however, little or no outlet has been found on the farm for the surplus yeast of the brewery, except possibly in the immediate neighbourhood of the larger centres of the brewing industry.

This surplus is very considerable, and the disposal of it to advantage has for many years occupied the attention of the brewer. At one time the surplus yeast of the brewery was largely utilised in the baking of bread, but in the last few decades, with the rise of the compressed yeast industry supplying a superior product for baking purposes, and with changes in brewing leading in many cases to the production of yeast of inferior value for baking purposes, this outlet for the brewers' surplus yeast has steadily diminished. No data are available for the output of British breweries, but for

Germany it was estimated for the year 1912 that of the total output of roughly 69,000 tons of brewers' yeast not more than 9,800 tons would be used by bakers.

Various attempts have been made to turn out from the brewery a yeast equal for baking purposes to compressed yeast, but without appreciable success.

More success has attended the efforts to prepare extracts of yeast suitable for human consumption as a substitute for meat extracts, but only a comparatively small proportion of the available yeast can as yet be disposed of in this way. Meanwhile much attention is being given to the possibilities of yeast as a food for farm stock.

The outstanding feature of yeast regarded as food is its high content of albuminoids, these commonly forming about 55 per cent. of the dry matter. Fresh yeast and pressed yeast have been used to some extent in feeding cattle and pigs, with apparently quite satisfactory results. In these forms, however, yeast is easily spoilt, and must be fed without much delay, especially in summer, so that it is only practicable to use it in the near neighbourhood of the brewery, and even there it must be procured in relatively small quantities at a time. Furthermore, owing to the fact that the yeast retains its vitality, scrupulous care is necessary to avoid contamination of other foodstuffs stored on the farm.

With the construction of more efficient drying apparatus it has now become possible to put on the market a dried yeast which is free from the foregoing objections, whilst retaining the nutrient matters of the yeast in highly digestible form. The output is as yet not very great, but that the industry is a rapidly growing one is indicated by the fact that, according to a summary recently published,* the number of yeast-drying works rose between 1910 and 1913 from 5 to 26. So far as the writer knows there are at present perhaps four or five yeast-drying plants at work in this country, with an annual output of some 2,000 to 3,000 tons. The product has so far been mainly exported to Germany, where dried yeast has grown in favour so rapidly that the demand is said to have exceeded the supply.

It is thus obvious that the practical experience of the German farmer with the food has been very favourable, and

* Hayduck: International Institute, Monthly Bulletin of Agricultural Intelligence, IV., 692 (May, 1913).

this is substantiated by the scientific and practical investigations carried out by Völtz and his colleagues in connection with the Institute of Fermentation Industries in Berlin.

It seems desirable, therefore, that, apart from the exceptional circumstances of the moment, the attention of the British farmer should be directed to this new feeding material, and especially that, if the claims as to its merits can be substantiated, every effort should be made to develop the home demand to such an extent as to render exportation in the future as unnecessary as it is undesirable.

With the object of gaining direct experience of the qualities of dried yeast as a foodstuff, observation and experimental tests have been made at the Manor Farm, Garforth (Experimental Farm of the University of Leeds and the Yorkshire Council for Agricultural Education) throughout the past winter.

Composition of Dried Yeast.—Before proceeding to deal with these experiments a brief exposition of the composition of dried yeast, and of the claims made for it, mainly on the basis of German experience and experiments, may first be given.

The material is of powdery to flaky consistency, varying in colour from light to medium brown. It has an agreeable smell; and its taste would not be amiss but for a bitterness, which is extremely pronounced in some samples, and which, according to experience at Garforth, is disliked by cows, but is not objected to by pigs and calves. This bitter taste arises presumably from the presence of hop residues with which the yeast is contaminated.

The composition of different samples is as follows :—

—	(1)	(2)	(3)	(4)
	Average			Per cent.
	Per cent.	Per cent.	Per cent.	a b
Moisture	4.3	10.40	5.73	10.9 —
*Crude Albuminoids ..	48.5	49.03	45.50	48.3 44.3
Oil	0.5	1.45	1.40	0.5 —
Crude Fibre	0.5	3.00	1.17	1.6 —
Ash	10.7	9.30	4.20	8.1 —
Soluble Carbohydrates, &c.	35.5	25.02	38.94	30.0 —
	100.0	100.00	100.00	100.0 —
*Containing Nitrogen ..	7.76	7.94	7.29	7.73 7.09

The figures under (1) have been put forward as a representative average for dried yeast, those under (2) and (3) are given in the advertisements of two different makes of dried yeast, whilst under (4) is given the composition of the material used¹ at Garforth.

The outstanding feature of the composition is the high percentage of albuminoids. Amongst commonly-used farm foods yeast is in this respect only equalled or closely approached by decorticated cotton seed meal or cake and soy bean meal or cake.

Digestibility.—Digestion trials in Germany with sheep have shown that fully 90 per cent. of the total organic matter, including practically the same proportion of the total albuminoids, is digestible.

Manurial Value.—In addition to the $7\frac{3}{4}$ per cent. of nitrogen, dried yeast contains phosphates equivalent to about $5\frac{1}{2}$ per cent. of phosphoric acid, and also about 2 per cent. of potash. Its manurial value, if assessed on the lines recently laid down by Hall and Voelcker, would thus amount to

Nitrogen.	Phosphoric Acid.	Potash.
$(\frac{1}{2} \times 7\frac{3}{4} \times 15s.) \div (\frac{3}{4} \times 5\frac{1}{2} \times 3s.) \div (\frac{3}{4} \times 2 \times 4s.)$		
or £3 16s. 6d. per ton—an extraordinarily high figure. The gross cost of the yeast used at Garforth amounted to £9 5s. per ton.		

Use in Germany.—German experience with dried yeast up to the present seems to have been uniformly favourable with practically all classes of stock, including poultry and geese, and especially with pigs. Occasional reference is made to difficulties with cows on account of the bitter flavour of the yeast.

Dietetic Properties.—In some quarters claims are made that the dried yeast has special dietetic properties which warrant a price considerably higher than that which would be deduced as reasonable from its composition, but until they have been substantiated by crucial experimental investigation the validity of such claims must be regarded as at least doubtful.

Tests with Dried Yeast at Garforth.—Feeding experiments with dried yeast have been carried out at Garforth with cows and pigs.*

* The writer is greatly indebted to Mr. H. J. Hargraves, N.D.A., for the care and success with which the practical work of the tests has been carried out.

The dried yeast used was a brown flaky material, with a pleasant aroma, but having a very bitter taste. The composition and cost have already been indicated.

Test with Cows.—Only eight cows giving sufficient milk for the purposes of the test were available, and these were divided into two lots of four each, regard being paid more especially to the stage of lactation of each individual in making the allotment. The test commenced on September 21st, 1914, and covered a period of 15 weeks, concluding on January 3rd, 1915. This period comprised four main experimental periods of three weeks each, during which the cows were fed as shown below—the allowance (per cow per day) of concentrated food only being shown, since the two groups were fed alike throughout the experiment so far as roots, hay, etc., were concerned.

			Average per Cow per Day.	
			Group A.	Group B.
1st Experimental Period (Sept. 21–Oct. 11) ..	7 lb. Cake.	7 lb. Cake.		
2nd " " (Oct. 26–Nov. 13) ..	7 lb. Cake.	4 lb. Cake, 3 lb. Yeast.		
3rd " " (Nov. 23–Dec. 13) ..	4 lb. Cake, 3 lb. Yeast.	7 lb. Cake.		
4th " " (Dec. 14–Jan. 3) ..	7 lb. Cake.	4 lb. Cake, 3 lb. Yeast.		

The three weeks not included in the periods tabulated represent the time taken up in gradually effecting the changes of feeding indicated.

The cake used was a mixture, in equal parts, of linseed cake and undecorticated cotton cake (Egyptian), costing £7 8s. 6d. per ton (linseed, £9 3s. 6d.; cotton, £5 13s. 6d.).

The test was thus a comparison of the relative merits of 3 lb. of the cake mixture, and 3 lb. of dried yeast, the introduction of the latter in place of the cake increasing the cost of the ration by 0·6d. per cow per day.

At first the cows showed a violent dislike for the yeast, even when its smell and taste were masked by the addition of a little treacle. With one or two individuals the difficulty experienced in securing complete consumption of the yeast

was indeed very great,* but eventually all were induced to consume it without apparent dislike, though never greedily.

The cows were milked twice daily, and the yields of milk recorded. The average daily yields for each group in each period were as follows :—

Period.	Average Daily Yield of 4 Cows.		For every 100 lb. milk given by Group A, Group B gave	Nature of Feeding.
	Group A. 2	Group B. 3		
1	lb.	lb.	lb.	5
1 ..	100.4	88.6	88.2	Both groups alike.
2 ..	96.0	91.2	95.0	Group B, yeast.
3 ..	88.2	81.7	92.6	Group A, yeast.
4 ..	78.3	74.2	94.8	Group B, yeast.

The comparison of the yields is most simply made by means of the data in the fourth column of the table. A small difference in favour of the yeast is indicated in periods 2 and 4.

Bearing in mind the small number of animals in each group, too much importance must not be attached to the actual numerical differences indicated. The only safe conclusion to draw is that, although there was an indication that the yeast was to some extent superior to the cake, the difference was too small to be measured reliably in a test with groups of 4 cows each.

No attempt was made to determine whether the yeast had any effect upon the percentage of fat in the milk, but the fortnightly tests to which all the cows of the Garforth herd are subjected gave no indication of marked differences between the "yeast" and "no yeast" periods.

The cows were weighed at fortnightly intervals throughout the experiment, and showed a steady gain of weight throughout, with a slightly increased rate during the "yeast" periods.

To sum up, it would appear that dried yeast is a food for cows if they can be induced to eat it, but the results obtained at Garforth do not warrant any extravagant claims as to its merits for this purpose. It is to be feared, however, that until some means of depriving it of its bitter taste has been devised, dried yeast will never come into general use as food for cows.

* Honecamp (*Mitt. der Deut. Landw. Gesell.*, Bd. 46, p. 635) reports that in his tests cows refused all food containing even small quantities of dried yeast.

Test with Pigs.—For the purpose of testing the merits of dried yeast in the feeding of pigs, two lots of 10 pigs each were selected. The pigs were all about 12 weeks old, and each lot was composed initially of 5 females and 5 castrated males, but deaths and the elimination of unsatisfactory animals eventually reduced one lot (Lot A) to 3 males and 3 females.

The general plan of the test was similar to that followed in the case of the cows, the yeast being introduced into the ration of each lot alternately in successive 3-weekly periods.

The test commenced on 5th November, 1914, and continued for 15 weeks, being completed on 18th February, 1915.

The foodstuffs used, other than yeast, were wheat "sharps," bran, barley meal, maize meal, and a little treacle, whilst, in addition, a little ground chalk was given. In every case where yeast was used it replaced an equal weight of "sharps," the rations in all other respects being always alike for the two lots. The comparison made was thus a contrast of the feeding values of equal weights of dried yeast and "sharps." There is a very great difference between the albuminoid contents of these two foods, the "sharps" used containing only 14.7 per cent., but it was thought that the results would be more immediately useful in practice if the dried yeast were compared with a foodstuff that is widely used in pig-feeding, than if some material comparable in albuminoid content with dried yeast, but little used in pig-feeding, were selected for the comparison. No milk or dairy waste was used.

The pigs were weighed as lots weekly, whilst for the greater part of the period the weight of each individual was ascertained roughly at each weighing. It will be seen from the data given later that at some stages of the experiment the rate of growth of the pigs was not very satisfactory. The reasons for this were not very clear, but could not be associated with the yeast-feeding, since trouble was experienced in both "yeast" and "no-yeast" periods. Practical opinions suggested over-feeding in the earlier stages as the primary cause of trouble, but there was little evidence of this beyond the presence of undigested food in the stomachs of the animals that died, and the writer inclines rather to the opinion that the trouble was due partly to constitutional defects in certain of the animals and partly to the rather cramped accommodation furnished by the pens utilised during the first half of the experiment. This is suggested by the facts that the trouble was much

greater with Lot A than with Lot B, that two of the three pigs that died were of the same litter, and that after removal to more commodious quarters, where the pigs had ample freedom for exercise, little or no further difficulty was experienced.

The average weekly gains in live weight per pig for each successive 3-weekly period are set out below:—

Period.	Lot A.		Lot B.	
	Weekly Ration per Pig.	Weekly Gain per Pig.	Weekly Gain per Pig.	Weekly Ration per Pig.
1	15.2 lb. Sharps. 3.8 lb. Bran. 3.4 oz. Chalk.	3.37	6.07	11.7 lb. Sharps. 3.8 lb. Bran. 3.5 lb. Yeast. 3.4 oz. Chalk.
2	10.9 lb. Sharps. 3.6 lb. Bran. 3.4 lb. Yeast. 5.6 oz. Chalk.	4.54	2.86	14.3 lb. Sharps. 3.6 lb. Bran. 5.6 oz. Chalk.
3	12.6 lb. Sharps. 3.4 lb. Bran. 1.5 lb. Barley. 5.6 oz. Chalk. 0.2 pint Treacle.	5.60	5.67	9.3 lb. Sharps. 3.4 lb. Bran. 1.5 lb. Barley. 3.3 lb. Yeast. 5.6 oz. Chalk. 0.2 pint Treacle.
4	9.7 lb. Sharps. 4.8 lb. Bran. 4.7 lb. Yeast. 4.8 lb. Barley. 5.6 oz. Chalk. 0.7 pint Treacle.	6.50	4.67	14.4 lb. Sharps. 4.8 lb. Bran. 4.8 lb. Barley. 5.6 oz. Chalk. 0.7 pint Treacle.
5	15.5 lb. Sharps. 5.5 lb. Bran. 0.5 lb. Barley. 4.7 lb. Maize. 5.6 oz. Chalk.	7.11	7.90	10.5 lb. Sharps. 5.5 lb. Bran. 5.0 lb. Yeast. 0.5 lb. Barley. 4.7 lb. Maize. 5.6 oz. Chalk.

The average gains for the "yeast" lot in each period are printed in italics, and it will be noted that in every period without exception they are higher than the corresponding gains of the "no yeast" lot, although in Period 3 the difference is negligibly small. Taking the experiment as a whole, the average weekly gain obtained with the rations in which yeast was included was *6.13 lb.* per pig, whilst without yeast the average was *4.72 lb.* per pig, a difference over a period of 15 weeks of *1.41 lb.* per pig per week in favour of the yeast. Against this

must be set the increased cost of feeding where yeast was used, which amounted on the average to 1.18*d.* per pig weekly. In other words, the extra live weight obtained by using yeast was obtained at a cost of $\frac{1.18}{1.41}$ *d.*, or $\frac{4}{5}$ *d.* per lb.

This result must be regarded as very favourable, and fully bears out the claims made that dried yeast is a very useful food for pig-feeding. It must not be taken as indicating that the yeast possesses special virtues which are not revealed by its composition as ordinarily expressed, since it is quite possible that other foods rich in albuminoids might have given equally good results. It can evidently be used successfully at present prices to supplement the more starchy foods widely used for pigs. Moreover, for pigs the bitter taste forms no drawback, since they will consume the yeast freely from the very outset.

No tests on experimental lines have been made at Garforth with other classes of stock, but calves to which dried yeast has been fed along with other food have taken to the food quite readily and have continued to make satisfactory progress, without showing any sign of digestive disturbance.

In the Garforth tests the food for the next day was mixed with water overnight and allowed to stand, whilst occasionally a few days' supply was prepared in advance. In no case did any appreciable fermentation take place, so that the vitality of the yeast cells is evidently completely destroyed in the drying process.

Summary.—Our experience with the food throughout the past winter may thus be summarised :—

1. Dried yeast has proved a safe food for cows, pigs, and calves.
2. For cows, dried yeast is not to be strongly recommended, since they show a special aversion to its bitter taste.
3. It has proved a good food for pigs, having given results markedly better than those obtained with an equal weight of wheat "sharps." Despite the increased cost of the ration on introducing dried yeast in the place of an equal weight of "sharps," the margin of profit on the feeding has been undoubtedly increased.
4. Dried yeast has proved a safe food for calves, but no evidence has been obtained as to its merits in comparison with other foodstuffs commonly used for calf-rearing.
5. Dried yeast keeps well, and on mixing with other meals and water may be kept for some time without objectionable fermentation taking place.

6. In arriving at these conclusions no account has been taken of the value imparted to the manurial excreta of the animals by the consumption of dried yeast. From its composition this may be expected to be as high as that of any other foodstuff commonly used on the farm.

7. Although the experience with dried yeast at Garforth, as outlined above, has been favourable, there is no reason to believe, either from the results of experiments or from careful observation of the general health of the animals throughout the tests, that the dried yeast possesses special medicinal or dietetic virtues which any other highly digestible food rich in albuminoids might not be expected to possess.

CHICKEN REARING AT MORDEN HALL, 1913-14.

AFTER the demonstration at Haslington Hall* was completed in the autumn of 1913, the Board, with the co-operation of the Cambridgeshire County Council, made arrangements for Mr. Paynter to continue his work in connection with the raising of chickens for the table at Morden Hall, Guilden Morden.

Morden Hall is situated about $3\frac{1}{2}$ miles from Ashwell Station, and lies in a somewhat sheltered position close to the village of Guilden Morden. The greater part of the land originally included in the farm had been divided into small holdings, but there still remained 13 acres of meadow land, $5\frac{1}{2}$ acres of orchard, the farm buildings, and a comfortable residence.

The grass land adjoins the farm buildings and is well sheltered; the soil is Greensand bordering on chalk, and is suitable for chicken rearing. The land had not been stocked with poultry for some time previous to the date on which Mr. Paynter entered into occupation. In addition to these advantages, the geographical position of Morden Hall was favourable to the object of Mr. Paynter's work, as it is situated near the borders of three counties where there are numerous small holdings.

The distance from a railway station was recognised as a drawback to the commercial success of the undertaking, but the many advantages of the situation commended it as a suitable place for the continuation of the trial.

* See *Journal* for March, 1914, p. 1049.

At the end of November, 1913, that part of the equipment which it was necessary to retain was removed from Haslington Hall, Crewe, to Cambridgeshire. While this involved a considerable amount of work, it was found possible, within a period of about four weeks, to dismantle the runs at Crewe and to re-erect the great majority of them at Morden Hall. No skilled labour was employed for this purpose, and the work was carried out by Mr. Paynter with the aid of an assistant. Four acres of the grass land were laid out in (1) runs suitable for chickens in the brooders, and (2) runs containing Sussex Night Arks to which the chickens were transferred at about the age of seven weeks, and in which they remained until marketed. The first batch of eggs was placed in the incubators on the 7th December, 1913. The general methods of incubation and rearing adopted by Mr. Paynter in 1913-14 were identical with those followed at Haslington Hall, and these methods have already been described in previous issues of the *Journal*.* In arranging for the supply of eggs during 1913-14 Mr. Paynter determined to pay higher prices than he had given in the previous year, with the object of obtaining a larger proportion of pure-bred chickens, and, if possible, more satisfactory results in regard to the percentage of chickens hatched.

The method of disposing of the chickens during the past season was the same as that followed in the previous year, viz., the birds were despatched alive in weekly consignments to London, but about 48 birds from each weekly batch selected for sale were handed over to a fatterer and were trough-fed and crammed. Particulars of the results of this trial will be found in a subsequent part of this article. When the war broke out it was considered desirable to retain a certain number of pullets for egg production. At that time there were in the runs about 1,500 pullets of ages varying from 6 to 16 weeks. These birds were neither the produce of bred for laying, nor were they hatched at a suitable season of the year for the production of winter eggs, but they formed a potential source for the supply of a large number of eggs, and it was decided to retain about 1,000 of them for this purpose.

These birds were transferred from the table chicken section to a laying section at the age of about 16 weeks, and the former section was credited with their value calculated at the price which was being received for the lean table chickens sent up to London.

The results of incubation during the season 1913-14 are set out in detail in Table I.

* Cf. *Journal*, June, 1914, p. 220; March, 1914, p. 1049; February, 1913, p. 902; and December, 1912, p. 721.

TABLE I.—Statement of Eggs Incubated and Numbers of Chickens Hatched.

Date.	No. of Hatched.	Bought.	Broken.	Infertile.	Not Hatched.	Chicks.	Cost of Eggs and Chickens.	Percentage hatched on total number of eggs incubated.	Percentage of chickens hatched after allowing for broken and infertile eggs.
December 7th	1	241	1	80	62	98		41	61
" 14th	2	423	—	98	180	136		32	42
" 21st	3	371	23	126	138	84		23	38
" 28th	4	203	1	40	12	61		30	37
January 4th	5	143	2	27	188	61		41	51
" 11th	6	360	3	78	188	91	Total cost of eggs— £102 12s. 11d.	25	33
" 18th	7	414	—	87	157	170		41	52
" 25th	8	295	34	54	142	75		32	46
February 2nd	9	396	6	64	141	185		35	56
" 9th	10	442	6	73	173	160		45	48
" 16th	11	384	3	71	159	160		39	52
" 23rd	12	434	—	85	224	145	Average cost of eggs per dozen—2s. 4½d.	33	42
March 1st	13	397	—	85	237	143		35	45
" 8th	14	524	2	82	237	203		39	46
" 15th	15	470	—	68	182	179		36	42
" 22nd	16	492	1	83	203	210	Day-old chickens bought —£1 7s. 6d.	45	54
" 29th	17	516	—	71	248	197		47	62
April 5th	18 (a)	345	—	28	120	85		57	62
" 12th	19 (b)	325	1	12	120	173		52	58
" 19th	20	401	8	27	171	186		52	57
" 26th	21	342	—	26	160	163		46	52
May 3rd	22	442	—	68	147	227		51	61
" 10th	23	386	—	63	157	160	Average cost of eggs per chicken hatched—5½d.	42	50
" 17th	24	378	—	42	152	184		49	55
" 24th	25	352	3	44	146	152		43	51
" 31st	26	370	9	36	147	148		40	50
June 7th	27	466	6	89	162	203		44	56
	—	10,431	112	1,828	4,206	4,285	—	Average 41.	Average 50.

The figures show that 10,431 eggs were purchased at a cost of £102 12s. 11d., or 2s. 4½d. per dozen, as compared with 9,897 in 1912-13 at a cost of £76 16s. 10d., or 1s. 10½d. per dozen. Mr. Paynter therefore paid about 6d. a dozen more for his eggs in 1913-14 than in the former year. The proportion of chickens hatched from the total number of eggs passed through the machines is the same in both years, viz., 41 per cent., but when the broken and infertile eggs are omitted from the calculation the proportion of chickens hatched from the remaining eggs is 50 per cent. in 1913-14 as compared with 51 per cent. in the previous season. The average cost for eggs for each chicken hatched was 4½d. in 1912-13, while at Morden Hall in 1913-14 the average cost amounted to 5½d.

The number of chickens sold or "taken over at a valuation" * amounted in 1913-14 to 3,549, as compared with 3,471 sold in the previous year, an increase of 78. The number of chickens which died or were lost in 1912-13 amounted to 557 (14 per cent.); in 1913-14 the losses amounted to 736 (17 per cent.).

These figures indicate that the additional cost of the eggs for hatching did not secure any higher percentage of chickens, a result which was anticipated as the eggs necessarily suffered as in the previous year from the effects of fairly long journeys by road and rail.

Local supplies were inadequate in quantity and not suited for the production of table chickens.

The advantage derived from the additional expenditure was found in the more uniform character of the birds as a whole; they were generally of a good table type and a large proportion of pure-bred chickens was secured, including Sussex, Faverolles, White Orpingtons and White Wyandottes.

The high percentage of birds recognised as suitable for table purposes among the chickens probably had a favourable effect; consignments were fairly uniform and this may have tended to increase the prices which were realised.

The average price per pound obtained for the "lean" chickens which were sold in 1913-14 was 9¼d., as compared with 8½d. in the previous year.

The cost of food was considerably reduced in 1913-14 despite the fact that during the last three months of the demonstration, that is from 1st August until 31st October, when the last birds were sold, the prices of feeding stuffs were very much higher. The cost of the food consumed was £248 13s. 10d.

* This valuation was always regulated by the market price obtained for strictly comparable consignments.

in 1913-14, and £275 7s. 5d. in 1912-13. In 1912-13, however, through unavoidable circumstances, one consignment of food was practically lost and represented in value a sum of not less than £10.

At the same time it should be noted that the average weight of the chickens sold at Haslington Hall was 4'024 lb., while the average weight of those marketed from Morden Hall was 3'900 lb. (see Table II.). In 1913-14 the average cost of

TABLE II.
Statement of Sales.

Date.		No. of birds.		Weight.	Value.
				lb.	£ s. d.
April	11th	..	..	48	183
"	18th	..	..	48	179
"	25th	..	..	64	229
May	2nd	..	..	24	91
"	9th	..	..	66	250
"	16th	..	..	68	240
"	23rd	..	..	88	334½
"	30th	..	..	89	319½
June	6th	..	..	116	413
"	13th	..	..	128	499
"	20th	..	..	161	604
"	27th	..	..	146	552
July	4th	..	..	128	489½
"	11th	..	..	107	405
"	18th	..	..	121	458½
"	25th	..	..	128	492
Aug.	1st	..	..	110	424
"	8th	..	..	129	495
"	15th	..	..	109	458½
"	22nd	..	..	81	363½
"	29th	..	..	69	299½
Sept.	5th	..	..	77	328½
"	12th	..	..	49	197½
"	19th	..	..	39	153
"	26th	..	..	63	257
Oct.	3rd	..	..	35	142
"	10th	..	..	48	204
"	17th	..	..	42	173
"	24th	..	..	61	259
Nov.	1st	..	..	52	221½
"	4th	..	..	34	132½
Total ..		..	..	2,533	9,878
In addition 1,016 chickens were retained in connection with the egg-producing scheme, their estimated value being					£131 4 6
Total value of chickens reared					£515 14 2

Average weight of chickens when sold .. 3'900 lb.
Average price received per pound .. 9½d.

food consumed per bird sold was 1s. 4 $\frac{3}{4}$ d. and the average price realised was 2s. 10 $\frac{3}{4}$ d.; in 1912-13 the corresponding figures were 1s. 7d. and 2s. 10 $\frac{1}{4}$ d.

The Profit and Loss Account (see Table III.) for 1913-14 shows a net profit of £45 11s. 4d., and this figure is lower than that of the previous year, when the net profit was £55 1s. 2d. It would be entirely misleading, however, to assume that these two amounts are strictly comparable, or that during 1913-14 the commercial results were less satisfactory than in the former year. A comparison of the Profit and Loss Account for 1912-13 with that now published will indicate at once that a number of items are included on the debit side of the latter statement which were not charged in the former account, and that other items have been increased. Mr. Paynter has always maintained that if his methods are to yield an adequate return the necessary labour must be supplied by the small holder and his family, and consequently any entry for wages should in fairness to this condition be regarded as a return obtained by the small holder and the members of his family for their labour.

The wages of an assistant in 1913-14 amounted to £33 6s. and this item appears on the debit side of the account. In addition to this, depreciation of plant was charged at the rate of 7 $\frac{1}{2}$ per cent. on £219 3s. in 1912-13; in 1913-14 depreciation was charged at 10 per cent. on £258 9s. 2d. and a considerable amount of the additional plant consisted of new appliances not absolutely necessary for the commercial success of the work. Thus, while the sum for depreciation was £16 8s. 9d. in 1912-13, it amounted to £21 13s. 3d. in 1913-14, an increase of £5 4s. 6d.

Capital was increased in 1913-14 by about £82 14s. 3d., and the charge for interest was thereby increased by £2 10s. 10d.

No charge for repairs and renewals was made in connection with the 1912-13 account.

While, therefore, the profit and loss account for the 1913-14 demonstration appears to show a decreased net profit in comparison with that of 1912-13, the sums set down as net profit for the respective years are not strictly comparable. It is quite clear that if the item for wages be regarded not as the wages of outside labour, but as a return for the labour of the small holder and his family, the profit would amount to £78 17s. 4d., a very considerable increase on that of the previous year.

The Profit and Loss Account (see Table III.) in connection with the season's work at Morden Hall has been drawn up as an actual statement, and not with any consideration of the

TABLE III.—Mr. F. G. Paynter's Poultry Demonstrations at Morden Hall, Guilden Morden, Cambs.

(1) *Lean Birds Demonstration. Profit and Loss Account, 1913-14.*

NOTE.—The 1912-13 Demonstration was completed on the 30th November, 1913. The 1913-14 Demonstration started on the 1st December, 1913, and was completed on the 31st October, 1914, and consequently covered a period of eleven months only.

Dr.		£	s.	d.		£	s.	d.	Cr.
31st October, 1914.					31st October, 1914.				
To Food consumed	..	..	..	..	By Chickens sold (1,454)	..	..	..	£ 114 16 5
" Eggs purchased	..	..	..	..	" Chickens (1,079) taken over by Fatten-	..	..	..
" Eggs sold	..	..	..	..	ing Birds Demonstration at agreed	..	..	..
" Chickens (day-old) purchased	..	..	..	..	valuation	..	..	..	169 13 3
" Chickens (5) returned by Fattening Birds	..	..	..	..	" Chickens (1,010) taken over by Egg	..	..	..
" Demonstration at agreed valuation	..	..	..	..	Production Demonstration at agreed	..	..	..
" Repairs and Renewals	..	..	..	..	valuation	..	..	..	131 4 6
" Railway carriage and cartage	..	..	..	..	" Manure sold	..	..	..	4 16 0
" Labour	..	..	..	..	" Eggs sold (from Pullets reared)	..	..	..	2 9 0
" Rent, Rates and Taxes (proportion	..	..	..	..	
applicable to Lean Birds Demon-	..	..	..	..	
stration)	..	..	..	..	
" Miscellaneous Expenses	..	..	..	..	
" Depreciation of Plant at 10 per cent.	..	..	..	..	
per annum	..	..	..	..	
£202 14s. 3d. for 11 months	..	18	11	8					
£25 14s. 11d. (Plant purchased	..								
during the year)	..	3	1	7					
" Interest on Capital, £382 14s. 3d. for	..	21	13	3					
11 months at 5 per cent. per annum	..	17	10	10					
Net Profit	..	£477	7	10					
	..	45	11	4					
	..	£522	19	2					
	..								£522 19 2

I have drawn up the above Account of the Lean Birds Demonstration at Morden Hall, Guilden Morden, for the eleven months ended the 31st October, 1914, and have examined the same with the books and vouchers kept by Mr. Paynter.

(Signed) P. J. LANGLEY,
Assistant Accountant Board of Agriculture and Fisheries

10001. 1015

special circumstances which Mr. Paynter maintains to be necessary for the successful rearing of chickens on this system by the small holder. The figures in the account may, therefore, easily be misinterpreted.

From these figures it is fair to assume that had a small holder worked at Morden Hall with a family sufficient to supply the necessary labour the return he would have obtained from the season's work may not unfairly be represented by the net profit, plus the amount paid in wages and the amount deducted as interest on capital. His return for the season would then be £96 8s. 2d., which represents 25 per cent. profit on the capital invested.

The results of last season's work emphasise the importance of the egg supply as a determining factor in the success of this method of chicken rearing. It will be noted from the figures which have already been given that every dozen chickens hatched by Mr. Paynter cost 5s. 9d. in eggs alone. This sum does not include carriage on the eggs or expenses of incubation.

The production of eggs for hatching in the immediate vicinity of the centre where they are required would probably considerably increase the percentage of chickens hatched, while the cost of providing the eggs could be reduced if stock birds were kept for the purpose on adjacent land. The percentage of losses during the past season was comparatively high, viz., 17 per cent., and may be accounted for to some extent by the depredations of hawks, which were very troublesome. The general health of the chickens was good, and accidents with the brooders were comparatively rare, although a few heavy losses were due to this cause.

Fattening Trial.—The test in regard to fattening chickens reared by Mr. Paynter, to which reference has already been made, was carried out with the object of ascertaining how far the increased price obtainable would justify the additional cost and labour of fattening.

Arrangements were made for the temporary employment of an assistant who had been trained in Sussex and who had several years' experience on rearing and fattening plants in that county.

Two very suitable sheds connected with the farm buildings were available. One was a long, open-fronted shed, facing the north west, in which the birds were trough-fed, and the other was a thatched shed with a cement floor in which there was a convenient means of regulating the amount of light

TABLE IV.—*Number, Weight, and Value of Birds when put into Fattening Pens and when sold.*

No. of Brood.	Number, weight, and value of birds put into fattening pens.				Number and weight of birds sold and prices realised.				Average increase in weight.		
	Date when birds were put up.	No. of birds put up.	Average weight of birds when put up (fasted).	Value per head when put up.	Total value of birds when put up.	Birds sold during week ending.	No. of birds sold.	Average weight of birds when sold (fasted).		Total sum realised from sales of birds.*	Average net price obtained per bird.*
			lb.	s. d.	£ s. d.			lb.	£ s. d.	s. d.	lb.
1	April 10	48	3.81	3 9	9 0 0	May 9	46	4.85	10 10 1	4 6 1	1.04
2	" 17	48	3.77	3 9	9 0 0	" 16	47	4.78	12 3 8	5 2 1	1.01
3	" 25	48	3.56	3 9	9 0 0	" 23	47	4.74	11 3 3	4 9 1	1.18
4	May 2	24	3.81	3 6	4 4 0	" 30	24	5.31	6 11 4	5 5 1	1.50
5	" 10	48	3.83	3 6	8 8 0	June 6	47	5.09	12 2 5	5 2	1.26
6	" 16	48	3.69	3 6	8 8 0	" 13	47	5.18	11 18 7	5 1	1.49
7	" 23	48	3.66	3 6	8 8 0	" 20	47	5.62	12 18 11	5 6	1.56
8	" 30	48	3.97	3 6	8 8 0	" 27	48	5.04	13 13 6	5 8 1	1.07
9	June 6	48	4.01	3 3	7 16 0	July 4	46	5.11	12 12 2	5 3	1.10
10	" 13	48	4.43	3 3	7 16 0	" 11	48	5.27	12 17 8	5 4 1	.84
11	" 20	48	4.26	3 3	7 16 0	" 18	47	5.10	11 0 9	4 8 1	.84
12	" 27	48	4.19	3 3	7 16 0	" 25	48	5.25	11 7 10	4 9	1.06
13	July 4	48	4.07	3 0	7 4 0	Aug. 1	48	5.04	10 13 11	4 5 1	.97
14	" 11	48	4.12	3 0	7 4 0	" 8	48	5.54	10 0 10	4 2 1	1.42
15	" 18	48	3.96	3 0	7 4 0	" 15	47	5.39	8 13 2	3 8 1	1.43
16	" 25	48	4.20	2 9	6 12 0	" 22	48	5.43	9 5 8	3 10 1	1.23
17	Aug. 1	48	4.20	2 9	6 12 0	" 29	47	5.42	8 12 3	3 8	1.22
18	" 8	47	4.15	2 9	6 12 0	Sept. 5	47	5.41	8 4 6	3 6	1.26
19	" 15	48	4.33	2 9	6 12 0	" 12	48	5.80	9 2 1	3 10 1	1.47
20	" 22	48	4.27	2 9	6 12 0	" 19	46	5.68	8 19 0	3 10 1	1.41
21	" 29	48	4.25	2 9	6 12 0	" 26	47	5.50	8 11 0	3 7 1	1.25
22	Sept. 5	48	4.16	2 6	6 0 0	Oct. 3	48	5.40	7 13 0	3 2 1	1.24
23	" 12	48	4.01	2 6	6 0 0	" 10	47	5.54	7 8 2	3 5 1	1.53
Total	—	1,080	—	—	169 13 3	—	1,063	—	236 18 4	4 5 1	—

* Less carriage and commission.

admitted, and where the birds could be free from disturbance. This shed was used for the birds when crammed by machine. The necessary appliances in the shape of fattening cages, a cramming machine and other utensils were provided. The birds were fed in accordance with the usual practice of Sussex fatteners, and special attention was given to the selection and purchase of foods, so that the ground oats and sharps might be both good in quality and as fresh as possible. The food was stored in a separate shed where the preparation and mixing were carried out. Suitable accommodation was also available for preparing the birds for market. The consignments were packed in "peds" and were sold on commission in the London market.

On and after the 10th April (see Table IV.) about 48 birds were handed over to the fattener each week from the batch selected for marketing in the ordinary way, and they were charged against the account at the average price realised by the remainder of the consignment when sold.

During the period from the 10th April to the 12th September, 1914, 1,079 chickens of an average weight of 4.05 lb. were transferred to the fattening pens; the average price per bird was 3s. 1 $\frac{3}{4}$ d. The birds were kept in the pens for about 21-25 days and the average increase in weight during that time was 1.23 lb. per bird which cost in food about 7d. to produce. The cost of food consumed amounted to £31 12s. 3d., and, after deducting 5 birds returned to the lean demonstration and 11 birds lost, 1,063 chickens were actually fattened and sold. The 1,063 birds realised a gross sum of £257 3s. 8d. or an average of 4s. 5 $\frac{1}{2}$ d. per bird after deducting carriage and commission. Each bird, therefore, gave on the average when fattened a return over the cost of food of 8 $\frac{3}{4}$ d.

In this connection it is well to call attention to the fact that, as compared with the average price paid by the higglers in Sussex for lean chickens, the prices at which the chickens were debited to the fattener in this trial were high. In April, May and June the Morden Hall birds were, on an average, costing the fattener 3d. each more than similar birds obtainable for fattening at that time in Sussex, and probably this discrepancy in price was greater as the season advanced. This increase in the cost of the lean birds represents a very considerable reduction in profit, but for the purposes of this trial it was important to ascertain the result of fattening the birds when taken over at the prices which they would have realised as unfattened chickens.

TABLE V.
Quantity of Foods used in each week of the Fattening Period.

Week ending.	Ground Oats.	Sharps.	Fat.	Milk.	Grit.
	lb.	lb.	lb.	Tins.	lb.
April 17th ..	70	35	$\frac{3}{4}$	$7\frac{1}{2}$	5
" 25th ..	150	76	6	8	5
May 2nd ..	179	71	$10\frac{1}{2}$	13	$5\frac{1}{2}$
" 9th ..	143	72	6	17	2
" 16th ..	231	51	$7\frac{1}{2}$	20	$2\frac{1}{2}$
" 23rd ..	147	95	9	21	$4\frac{1}{2}$
" 30th ..	243	65	11	25	$1\frac{1}{2}$
June 6th ..	270	83	13	25	7
" 13th ..	279	108	14	27	4
" 20th ..	272	88	11	24	2
" 27th ..	227	101	10	27	6
July 4th ..	188	121	5	21	5
" 11th ..	183	138	$11\frac{1}{2}$	8	5
" 18th ..	215	122	6	20	1
" 25th ..	186	123	7	20	4
Aug. 1st ..	187	155	$10\frac{1}{2}$	20	$5\frac{1}{2}$
" 8th ..	191	153	11	22	$4\frac{1}{2}$
" 15th ..	206	178	$14\frac{1}{2}$	23	6
" 22nd ..	154	132	$10\frac{1}{2}$	20	13
" 29th ..	186	174	$26\frac{1}{2}$	18	6
Sept. 5th ..	174	214	12	23	6
" 12th ..	134	152	6	25	$3\frac{1}{2}$
" 19th ..	174	167	$10\frac{1}{2}$	18	6
" 26th ..	138	100	$10\frac{1}{2}$	21	4
Oct. 3rd ..	79	84	7	8	..
" 10th ..	23	16	2	2	..
Total ..	4,629	2,864	249	$489\frac{1}{2}$	$112\frac{1}{2}$

TABLE VI.
Summary of Results.

Number of chickens put into fattening pens ..	1,079.
Average weight	4.05 lb.
Value per head	3s. 1 $\frac{1}{4}$ d.
Number returned to grass pens	5
Number sold fat	1,063.
Average weight when sold	5.28 lb.
Average price obtained after deducting carriage and commission	4s. 5 $\frac{1}{2}$ d.
Average increase in weight	1.23 lb.
Weight of Food used :—	Cwt. lb.
Ground Oats	41 37
Sharps	25 64
Fat	2 25
Grit	1 0 $\frac{1}{2}$
Milk	$489\frac{1}{2}$ tins.

TABLE VII.—*Mr. F. G. Paynter's Poultry Demonstrations at Morden Hall, Guilden Morden, Cambs.*
(2) *Fattening Birds Demonstration. Profit and Loss Account, 1913-14.*

Dr.	£	s.	d.	Cr.
31st October, 1914.				£
70 Chickens (1,079*) taken over from Lean Birds Demonstration at agreed valuation	100	15	3	257
" Food consumed	31	12	3	3
" Railway carriage and cartage†	15	10	1	17
" Labour	21	7	0	3
" Salesmen's commission	12	14	0	3
" Rent, Rates and Taxes (proportion applicable to Fattening Birds Demonstration)	2	0	0	9
" Miscellaneous expenses	1	11	9	1
" Depreciation of plant (£11 4s. 7d. at 10 per cent. per annum, part year only)	12	10		2
" Interest on Capital, £70 for 11 months, at 5 per cent. per annum	3	4	2	
	£258	6	1	
Net Profit	4	0	4	
	£262	6	5	£262

* 11 Chickens were lost by death. &c. † See Note on Lean Birds Demonstration Profit and Loss Account.

† Of this sum £7 11s. 4d. represents cartage on chickens. I have drawn up the above Account of the Fattening Birds Demonstration at Morden Hall, Guilden Morden, for the eleven months ended the 31st October, 1914, and have examined the same with the books and vouchers kept by Mr. Paynter.

13th February, 1915.
(Signed) P. J. LANGLEY,
Assistant Accountant, Board of Agriculture and Fisheries.

There is another factor to be considered in estimating the results of this test, viz., that chickens prepared by Mr. Paynter's method are not—when selected for sale—"lean" chickens in the ordinary acceptance of that term, and it is doubtful whether they require the same amount of preparation as ordinary lean chickens. Some trials conducted in the autumn of 1914, while by no means conclusive, tend to suggest some modifications in the method hitherto adopted.

The wages of the fatterer have also to be considered. The time occupied in dealing with 48 birds a week or a maximum of say 150 was comparatively short and it would probably have been possible for him to handle 120 birds a week. Therefore, the whole of his wages have not been debited to the fattening account (see Table VII.), but have been apportioned, and three-eighths of the total only has been charged to the account. The wages paid were necessarily higher than those which obtain for permanent employment. The results of the trial are interesting as affording actual figures in connection with a fairly large number of birds, and indicate that where the necessary experience, skill and labour are available, the fattening of chickens reared by this method is likely to yield a reasonable return.

It is quite clear that fattening is a special branch of poultry production involving considerable skill and experience, and one in which mismanagement may lead to very serious losses. The general Sussex practice of keeping the two branches of rearing and fattening chickens in the hands of separate individuals is undoubtedly sound, and suggests the importance of co-operation among small holders as the most promising means of success in producing finished table chickens. Few small holders outside certain well defined areas would possess either the knowledge or the experience required for successful cramming, and it is doubtful whether the results of trough feeding alone in the case of chickens prepared by this method would produce a degree of improvement commensurate with the trouble and expense. From the Profit and Loss Account in connection with this trial it will be seen that a small holder skilled in fattening would have obtained in return for his labour a sum represented by the net profit, plus the amount paid in wages, together with the deduction for interest on capital, *i.e.*, a total of £28 12s. 3d.

The labour involved in connection with this demonstration and trial was considerable, and the Board desire to record their appreciation of the conscientious thoroughness with which the work was carried out at Morden Hall during the period under review.

SUGGESTIONS FOR THE CULTIVATION OF CATCH CROPS AND HOME GROWN FEEDING STUFFS.

THE enhanced prices obtainable at the present time for corn, beef and other products, the high cost of feeding stuffs, the shortage of labour, and other circumstances must inevitably tend to some readjustment of existing agricultural methods and practices even if only of a temporary character. While an increased production of corn and potatoes is of the greatest importance, it is also very desirable that steps should be taken to ensure a larger supply of home-grown food for stock. It may be useful, therefore, to discuss briefly some of the ways in which an increased quantity of useful produce may be obtained without seriously disorganising the normal farming methods.

The relative cheapness of most artificial manures affords a ready means of profitably increasing the output of both arable and grass land. Judicious expenditure on inferior grass land would almost certainly result in both immediate and lasting benefit. In the case of arable land, moderate applications of suitable manures should not only result in bigger crops but cleaner land. Bare fallows should, as far as possible, be dispensed with, or where absolutely necessary, be replaced by bastard fallows. It may be desirable in some cases to modify the existing rotation. Much of our arable land is farmed on the Norfolk four-course system, which may result in the soil being without a crop for nearly as long a period as it is cropped; after corn crops, after roots, and after potatoes, the soil usually lies idle throughout the winter, and more than one crop per annum is seldom harvested from the land.

In the case of soils in wet or late districts more intensive cropping may be impracticable, although even in the northern counties the plan of sowing some clover along with oats has given profitable crops of late autumn fodder for sheep. In the southern districts of England successional cropping might well be more extensively followed. After early potatoes, after peas, and even after an early corn harvest, catch crops are often possible, and may prove invaluable by providing green food for stock in the late autumn, winter, and spring following. These catch crops would be specially useful when prolonged drought may have diminished the ordinary hay and root crops of the season. In districts which

are specially affected by dry, hot summers much less reliance should be placed on pastures and root crops than at present, and more attention should be given to the cultivation of other forage crops.

Poor crops of roots are much too common in the south, and on many farms it would be a distinct gain if a proportion of the root "break" were set apart for the growth of other green crops. When appropriate green supplementary crops are selected they need never be wasted, for they may be grazed, fed green, or made into hay or ensilage, as found convenient.

It is not generally realised that in many districts a mixture of corn and vetches, with perhaps a few beans for support, will produce about as much green food per acre as the average crop of roots. Converted into silage this mixed crop would yield a highly nutritious winter fodder. In a modern silo of the American stave pattern practically no waste occurs, and the somewhat elaborate precautions in regard to pressure and temperature, hitherto considered essential in connection with older methods of ensiling, may be largely disregarded. Filling may proceed at convenient opportunities, and no pressure other than that incidental to spreading the green stuff appears to be necessary.

In addition to supplementing or replacing roots in dry districts, silage, as has long been recognised, may prove a useful addition to hay in grass districts subject to a heavy rainfall.*

The special uses of the crops available for the purposes above referred to are briefly indicated in the notes which follow. The total number of suitable catch crops is considerable, so that in arranging a scheme of cropping for any particular district a selection can be made to suit the varying local circumstances of soil and climate.

Catch Crops.

Rye will usually prove most serviceable when sown in July or August. If sown before the end of August it is generally advisable either to cut or to graze the crop in October and allow the second growth to come in for the following April and May. When sown early, rye will grow too rank to stand over the winter if the grazing or cutting is omitted.

If in spring the rye is grazed or mown before the ear appears in the stalk, and the land is then well bush-harrowed and

* Further information on Ensilage is given in Leaflet No. 9 (*Ensilage*).

rolled, the rye will grow again and ripen into a grain crop. For this purpose the St. John's Day Rye, owing to its greater tillering capacity, is more suitable than any other kind, but it has been difficult to obtain seed of this variety in recent years.

It will usually be advisable to follow green rye with another green crop, *e.g.*, turnips, rape or kale. For green forage rye should be sown thickly, at the rate of at least 4 bushels per acre. Rye is a drought-resisting plant, is capable of growing at a high altitude, and succeeds on almost any class of soil. For the production of the maximum amount of forage, however, it is necessary that the land should be in good condition. Where the soil is poor a spring dressing of $\frac{1}{2}$ to $\frac{3}{4}$ cwt. of nitrate of soda or some other nitrogenous manure should be applied.

Italian Rye-grass when sown very thickly in July or August is fit, under favourable conditions, to graze in late autumn. In the following spring it might again be grazed or left for early mowing. It starts growth early in spring, and, if encouraged by dressings of nitrogenous manures, will prove an excellent stand-by for dairy farmers who may be short of forage in the late spring months. On sewage farms, or where irrigation is possible, Italian rye-grass will afford several cuttings in a year. The usual rate of seeding is from 2 to 4 bushels per acre. With a view to providing early keep for ewes and lambs in spring, a few pounds of Italian rye-grass may be included in a clover seeds mixture. This practice is recommended for districts in which clover is apt to fail. On the other hand, there is a risk of injuring the succeeding wheat crop on some soils if the grain crop is not suitably manured.

Western Wolths Grass resembles Italian rye-grass, but grows faster and reaches maturity in about two months. It might be utilised as a means of filling up blanks in a thin clover plant, or for sowing after early potatoes for autumn grazing.

White Mustard grows very rapidly, and may be sown where turnips and mangolds have failed, or it may be broadcasted upon stubbles broken up by the cultivator or disc harrow. If 14-16 lb. of seed be sown per acre, with $1\frac{1}{2}$ to 2 cwt. of superphosphate, there should be good sheep food in six weeks or less under the most favourable conditions. Sown as late as the end of August, mustard will usually yield good food by the end of November. If not required for sheep feeding the crop may, with advantage, be ploughed in as green manure. This crop does not stand a hard winter.

Brown Mustard is grown only for its seed. It thrives best on rich loam, and is often taken as the first crop after breaking up grass land, as it is not commonly attacked by wireworms.

The seed is usually drilled at the rate of 3-4 lb. per acre on a fine tilth in March or April and lightly covered. The crop is thinned out early in May. It is also frequently sown broadcast at the rate of 1 peck per acre. Harvesting takes place in September when the lower pods are beginning to turn brown; if delayed longer, seed is apt to be lost. The crop is commonly cut with a hook, and tied into sheaves or laid on the stubble in handfuls. It is usually ready for carting after 3 or 4 days of dry weather. The average yield is very variable, but a well-grown crop should produce about 25 bushels per acre; the cost of cultivation is low, and a good crop of mustard seed is a valuable one. Dry harvest weather is essential, and the crop is almost confined to the eastern and south-eastern counties.

Rape may be drilled in the old rows where mangolds or swedes have failed, or sown broadcast on stubbles broken up by the cultivator or disc harrow. It is usually unnecessary to single rape. If excessively thick, plants sown on the flat may be thinned by cross-harrowing. The usual seed rate is 3 lb. if drilled, or 5 to 6 lb. per acre if sown broadcast.* Rape may be sown at any time from April to August. If seed is sown in April the crop will be fit to feed off in August, and again later in the autumn. When sown in July, the crop will be ready for use in October and November. Rape is mainly grown as fodder for sheep, but it is also an excellent supplementary food for pigs and other stock.

Thousand-headed Kale, when drilled in July or August, well manured and afterwards singled, will under favourable conditions supply a valuable and very bulky food for both sheep and cows in early spring from March onwards. When sown in March, April and May the crop will be ready for use in October, November and December.

Thousand-headed kale has taken the place of rape in many districts, as it yields a heavier crop. It reaches its maximum development on good land after being singled, but in the ordinary course, when the crop is grown for autumn use, singling is by no means generally practised. It is extremely

* It is desirable that the seed should be large and well-filled, and of a good strain. The so-called "Giant" rape does not appear to be stocked as such by seedsmen, though rape is variously sold as "Giant," "Giant Essex," "Dwarf Essex," "Broad-leaved," and "Broad-leaved Essex" rape. The varieties or strains, however, are not distinguishable as seed. Farmers are recommended to secure rape seed from a thoroughly reliable source.

hardy, and is capable of resisting both frost and drought. The seed is drilled at the rate of 4 to 6 lb. per acre, or sown broadcast at the rate of 10 lb. per acre. In some parts of the eastern counties kale forms a part of the ordinary fallow crop, being sown in alternate rows with swedes and kohl-rabi. It affords food and shelter for lambs. The crop transplants well.

Marrow-stem Kale is said to be the result of a cross between thousand-headed kale and kohl-rabi. The stem is longer and thinner than that of kohl-rabi and is topped with a bunch of green foliage similar to that on thousand-headed kale. Stock readily eat both stems and leaves. One of the chief merits of this plant is its power of resisting drought. It is sown in the same way as turnips, from the middle of April till the end of June.

Hardy Green Turnips.—The Hardy Green Round Turnip is a variety of white turnip specially adapted for late sowing. It will continue to grow during open weather in winter. In Ireland this turnip is sometimes sown broadcast, when it grows up like rape, the tops for which the crop is chiefly grown being exceptionally abundant. The tops may be cut, or the crop may be pulled, and the entire produce fed to stock. If, when the crop is cut, care is taken to leave a small portion of the stem above the root tops, a second crop of tops is obtained. When cultivated in this way in Ireland hardy green turnips sown in June are fit to cut in September, and yield a second crop by the following February or March. The crop is more suitable than rape for light and poor soils. The seed should be sown broadcast by means of a seed "fiddle" at the rate of 4 to 5 lb. per acre, and rolled in. Moderately thin sowing is important. as, if sown too thickly, the crop is injured by frost.

Rye and Rape Mixed.—For a mixed crop of rye and rape a useful proportion of seed to sow is about $2\frac{1}{2}$ bushels of rye and $2\frac{1}{2}$ to 3 lb. of rape per acre. The rye may be either drilled or sown broadcast and harrowed in, and the rape afterwards sown broadcast and covered by rolling. In no circumstances should the rye and rape be mixed before sowing, as, if this were done, even distribution of the seed would be impossible, and the covering necessary for the rye would be altogether too much for the rape. It is often an advantage, especially on peaty soils, where rape grows very rapidly, to allow an interval of about a week or ten days between the sowing of the rye and the rape seed, in order to minimise the possibility of the rape smothering the rye.

Maize.—This plant is very easily injured by frost, and is not suited to cold or wet districts. In the warmer southern counties, however, where pastures are liable to fail prematurely, especially in dry summers, maize has proved most useful as a supplementary green food for stock. On good land, manured with dung and artificials, as much as 30 tons per acre of green forage may sometimes be grown. Seed of a suitable variety, e.g., White Horse Tooth, should be ploughed in about the latter end of May, the seed being dropped either in every furrow or every alternate furrow. In view of the possible necessity for subsequent hoeing the narrower distance should be adopted only on clean land in good mechanical condition. The usual rate of seeding is about 2 bushels per acre. Attempts to ensile maize in this country have met with very fair success, and in view of the high feeding value of the crop and the heavy yields which may be obtained, it seems desirable that further attention should be given to this aspect of maize growing. In America maize is chopped up and stored in stave silos with complete success. (See also Leaflet No. 73, *Cultivation of Maize for Fodder*.)

Sorghum requires climatic conditions similar to those for maize. Two varieties, viz.—*Sorghum vulgare* and *Sorghum saccharatum*, may be successfully grown in the southern counties. *Sorghum* produces rather less forage than maize but is ready for cutting a week or two earlier. The usual rate of seeding is about 20 lb. per acre, and the seed is drilled in rows, 6 or 7 in. apart.

Buckwheat will grow on poor, light, dry soils in warm districts where other crops would yield little or no produce. Considerable tracts of such land are to be found in the south-eastern and southern counties of England. Buckwheat is also a useful crop on low-lying fens. It grows rapidly and may be sown from the middle of May to the middle of July, the earlier sowing being advisable for seed production, the later being more suitable for green manuring. For seed it should be drilled in rows 12 to 15 in. apart at the rate of 1 bushel per acre; for ploughing in green, 2 to 3 bushels may be drilled or sown broadcast.

Buckwheat produces a succession of flowers right into late autumn. The seed ripens at different times, but the crop must be harvested about the end of August or beginning of September before all the seed has had time to form, or the early seed would fall. In view of this peculiarity considerable care is required in harvesting. The yield varies

greatly, but from 3 to 3½ qr. per acre may usually be expected. It is a useful food for poultry and pheasants.

Crops Suitable for Replacing Purchased Feeding Stuffs.

The most expensive constituents of purchased feeding stuffs are the albuminoids. The foods which the farmer usually grows—corn, roots, and straw—are relatively poor in albuminoids, and are chiefly valuable for the carbohydrates which they contain; it is, therefore, necessary to purchase feeding stuffs rich in albuminoids, such as decorticated cotton cake and soy bean cake, to make good the deficiencies of home-grown crops. In view of the scarcity and high cost of most of the feeding cakes at the present time, it is desirable that farmers should endeavour to replace them, to some extent, at least, with those home-grown crops which contain most albuminoids, such as linseed, beans and peas, clover, and vetch hay or silage.

Linseed may be sown from mid-April to mid-May, at the rate of about 1½ bushels, or 78 lb., per acre, and the crop should be ready for harvesting in August. If well grown a crop of 10 cwt. per acre may be expected. Crushed linseed is specially valuable in the rearing of calves, and for mixing with starchy foods in the feeding of all growing and fattening stock. Full particulars regarding this crop will be found in Leaflet No. 278 (*The Growing of Linseed for Feeding Purposes*).

Beans form a highly nitrogenous feeding stuff. In the rations of dairy and fattening stock beans may largely replace cotton and linseed cakes. Beans are also most useful in feeding young growing animals and horses engaged in heavy work. An account of the cultivation of this crop is contained in Leaflet No. 268 (*The Cultivation of Field Beans*).

Peas.—Two species of peas are commonly cultivated, namely, the Field Pea and the Garden Pea. There are many varieties, differing in character of haulm, time of ripening, and colour and form of seeds. The seeds of the field varieties are generally grey or dun-coloured, and are mainly used for stock-feeding. Field peas are best grown upon light or medium soils containing a moderate percentage of lime. They may sometimes replace clover in the rotation, or they may be cultivated as a partial fallow crop or as a first crop after old ley. Three bushels per acre should be drilled in rows about a foot apart, on a well prepared seed-bed in February and March, and three or four hoeings are commonly required in the course of the growing season. The crop should be

cut when the lower pods are beginning to turn brown, and left loose on the ground. It is subsequently turned over a few times until ready to be cocked, after which it is stacked and threshed with as little delay as possible. Care is required in harvesting, as the seed is liable to be lost, especially in hot and showery weather. The average yield is about 32 bushels per acre.

In early districts, garden varieties of peas are grown in the field for picking green for culinary purposes in the latter end of June and in early July, after which the land may be fallowed until autumn or sown with a suitable catch crop. In later districts, or where green peas cannot be profitably marketed, the ripe seed is harvested.

Crimson Clover (*Trifolium incarnatum*) in its three varieties, early, medium and late, may be sown during August or early in September to come in for use successively in May and June. The chief value of *Trifolium* lies in the ease of its cultivation and the rapidity of its growth. It provides early grazing for stock, or a crop which can be cut for horses or cattle at a time when green food is scarce. It is best adapted for warm, loamy, and gravelly soils in mild and early districts, and is seldom sown on cold or late land, as autumn rains and severe winter frosts injure it. Immediately after the corn crop is removed the surface of the ground is broken up with drag or disc harrows, so that the necessary covering for the seed may be obtained without loosening the underlying soil. The seeds are sown on the scarified surface, after which the ground is lightly harrowed and firmly rolled.

It is absolutely essential that this crop should be sown on a firm and solid seed-bed. The rate of seeding varies from 15 to 25 lb. or more per acre, according to the nature of the seed-bed, the smallest quantity of seed being required where the conditions are most favourable for growth. Crimson clover is much used for filling up blanks in ordinary clover crops.

It is not suitable for hay, and should never be fed to stock after flowering has ceased on account of the liability of the hairs of the mature flower-heads to form hair balls in the intestines. This crop is more fully dealt with in Leaflet No. 182 (*Crimson Clover*).

Vetches may be sown in autumn for use in spring, or sown in spring for use in late summer and autumn. A proportion of wheat, rye, oats, or beans is usually sown at the same time to afford support to the vetches. On poor soils a mixture of oats and vetches usually gives a better return than oats.

done. On well-manured soils heavy crops of excellent fodder may be grown from a mixture of vetches and a cereal, with a sprinkling of beans for support. For soiling purposes or for ensilage it is usual to drill from 2 to 3 bushels of vetches per acre along with 1 to $1\frac{1}{2}$ bushels of oats, wheat or rye, or a mixture of these. When required for hay a smaller proportion of vetches should be sown, as it is very desirable to prevent the vetches from lodging, and to grow a crop that can be stacked quickly. A useful mixture for a vetch hay crop intended to provide fodder for cattle or sheep would be 70 lb. of winter vetches, 2 to $2\frac{1}{2}$ bushels of winter oats, and $1\frac{1}{2}$ to $1\frac{3}{4}$ bushels of winter wheat or $1\frac{1}{2}$ to $1\frac{3}{4}$ bushels of winter barley, per acre. Beans should be omitted when hay is the object. From seeds sown in September or October a crop should be fit to cut by about the middle of the following June. A certain amount of judgment is needed in deciding when to cut the crop. If cut too young the vetches wilt and fall into dust; if left uncut too long the crop becomes fibrous and stock refuse it. The right time to cut is when the small seeds in the pods at the base of the plant are about half-formed.

The method of cutting and saving the vetch mixture is precisely the same as in the case of "seeds" hay, except that it is desirable to sweat the crop in the stack a little more. As the crop is cut at a time of year when the rainfall is usually low and the sunshine abundant no great difficulty need be anticipated in making it into hay. In wet seasons, however, it may be desirable to make silage.

After the removal of the vetch crop, the ground may be pastured, fallowed, *i.e.*, ploughed or cultivated and left uncropped till sown with wheat in autumn, or it may be preferable in the interval to sow a suitable autumn catch crop.

Continuous Green Cropping.

A method of growing vetches and other green crops which might often be used is the following* :—The vetch hay break should be divided into three sections, A, B and C. As soon as Section A has been cleared of vetches it is prepared for rape which is sown in the latter end of June. Section B is subsequently sown with hardy green turnips (broadcast) in early July, and Section C with a mixture of rye and rape in late July. The first crop (A) provides useful fodder from September to mid-December, the hardy green turnips are used from mid-December

* Cf. articles on "Continuous Cropping" by T. Wibbenley in the *Journal of the Board of Agriculture*, November and December, 1914.

to the end of February, and the rape and rye are consumed during the months of March and April, thus providing a continuous supply of green fodder throughout the winter. The rape used in September and October may be expected to yield a second crop in the following March, when it may be grazed off by sheep and lambs.

Substitutes for Roots and Concentrated Feeding Stuffs.

As compared with the ordinary method of root-growing the cultivation of winter-green crops (hardy green turnips, rape, etc.), involves a considerable reduction in labour. Broadcasting may take the place of drilling; on suitable soils in a suitable climate the crops may be eaten on the land, thus saving cartage of food and manure; the green stuff may be cut if necessary and be fed indoors in the usual way, or on an adjoining pasture.

In an experiment* conducted recently on the farm of Sir Horace Plunkett in County Dublin it was found that for winter milk production a daily ration consisting of—

14 lb. Oat and Vetch Hay,
14 lb. Meadow Hay, and
70 to 84 lb. Rape or Hardy Greens,

proved quite as useful as—

21 lb. Meadow Hay,
56 lb. Roots,
3 lb. Maize Meal, and
3 lb. Decorticated Cotton Cake.

It was estimated that the cost of the former ration was approximately half that of the latter.

The foregoing list is not intended to be exhaustive, but includes the most important of those crops which are suited for catch-cropping and providing home-grown feeding stuffs.

Manuring.

In many cases the residues from the manures applied to previous crops will suffice, but if these are considered insufficient, such dressings as the following will usually give good results :—

Green Fodders belonging to the Grass Family.—Top dressings of nitrate of soda or other suitable nitrogenous manure, at the rate of about 1 cwt. per acre, repeated if necessary.

Crops belonging to the Cabbage and Turnip Family (rape, kale, mustard), and also maize :—

* Cf. articles on "Continuous Cropping" by T. Wibberley in the *Journal of the Board of Agriculture*, November and December, 1914.

8 to 10 tons of dung	} per acre.
1½ to 4 cwt. superphosphate	..	..	..
¾ cwt. sulphate of ammonia, or 1 cwt.				
nitrate of soda.				

If dung is not available the quantities of artificials should be increased.

Crops belonging to the Pea Family (vetches, &c.):—

8 to 10 tons of dung per acre, or	} per acre.
2 to 3 cwt. superphosphate, or 2 to 2½ cwt.	
basic slag.	
3 cwt. kainit (when available at ordinary prices ; too dear at present).	

NOTES ON MACHINERY AND THE LABOUR SUPPLY.

W. J. MALDEN.

It is often urged that the British farmer is slow to adopt the latest types of farm implements. While there may be some truth in this, it is not always because he fails to appreciate their value. For some kinds of work he may prefer the greater thoroughness and accuracy of hand labour, or it may be that with a sufficient supply of labour available it is more economical, taken in conjunction with other work on the farm, to have the work done by hand. It must be remembered, moreover, that some of the earlier forms of machinery failed to fulfil the claim made by the makers, and that many were tried only to be discarded in favour of the older forms. During the last few years, however, most of the types of farm machinery have been immensely improved, and farmers may now make use of them with every confidence that they may be depended upon to do the work efficiently and at relatively small cost.

In the past the introduction of farm machinery has always been intimately connected with the labour supply. Any abnormal migration of rural workers from the land has usually been followed by a large increase in the use of machinery. As the present War is likely to lead to an unprecedented shortage in both men and horses, farmers will do well to prepare for this by considering the possibility of making a more extensive use of the many labour-saving implements which are now available.

Agricultural Tractors.—Steam engines have been used in ploughing for over half a century, but this method of tillage has never quite fulfilled early expectations, and during recent years it has receded rather than advanced in popularity. As an auxiliary to horse implements, and as a means of breaking up large tracts of land in fine weather, there is no doubt that steam ploughs have proved valuable to the farmer, but they have a number of disadvantages. The excessive weight of the engines, their great cost and lack of adaptability to other work, and the number of men and horses required to supply them with water and coal, have all helped to render them unpopular. Their work, moreover, is somewhat rough and uneven for British farming.

The unpopularity of the steam plough is due also in some measure to the construction of the multiple plough on wrong principles. As designed at present there is not sufficient clearance between the bodies to allow farmyard manure or rubbish to pass through freely, and owing to the rigid body the plough does not readily enter hard land. It is often difficult to make a single body plough set in promptly when the ground is hard, and the difficulty is increased with the multiple plough. A further objection is that on land lying in ridges or furrows, or where the surface is irregular or uneven, good work is impossible. Hollows and furrows will only be lightly touched, while ridges will be torn unduly deep. Steam ploughing would be much more popular if implement makers would construct multiple ploughs with self-adjusting breasts or with breasts easily adjustable by the operator.

The petrol or paraffin-driven agricultural tractor has not been very much used for farm work up to the present. The early forms of this type of tractor were crude, often inferior in workmanship and lacking in reliability. Now, however, efficient motors have been placed on the market by firms whose reputation for good workmanship is a guarantee of durability, and it is probable that they will rapidly come into general use.

The agricultural tractor is at present taking two main forms, (1) A powerful machine capable of drawing several ploughs and suitable for large farms or for letting out on hire. This form would also be available for such heavy work as drawing the biggest threshing machines and for road haulage. (2) A smaller tractor capable of pulling fewer ploughs, lighter cultivators, binders, and mowing machines, and for driving small threshing drums, chaff-cutters, etc. This form would be suitable for farms of average size and could be used for much of the work

hitherto done by horses. Tractors of very small power are not practicable, as so much of the total power is taken up in travelling over the land, especially when it is soft or loose.

There seems to be little doubt that the tractor is more economical than horse power. The following figures are given as showing the actual costs of working of three different types of tractor which are now on the market. No. 1 is a 40 h.p. tractor which may be regarded as taking the place of the old type of steam-plough engine. Working from 4½ to 9 in. deep it will plough from an acre to an acre and a half of land per hour according to the depth of ploughing and the nature of the land. Assuming that 1½ acres are ploughed per hour, the costs of working per day of 10 hours are :—

	Cost per day.		
	£	s.	d.
Petrol, 2 gallons per acre at 1s. 3d. per gallon	1	11	3
Oil, 1 quart per acre at 1s. 6d. per gallon		4	8
Driver's wages at £2 per week		6	8
Ploughman's wages at 22s. per week		3	8
Interest on £550 at 5 per cent. per annum		1	0
Insurance			10
* Depreciation, 5 years' life: scrap value £50		5	0
Repairs, based on experience, 3d. per acre		3	1
Cost per day	£2	17	2

Cost per acre—4s. 7d.

In addition to ploughing this machine will be available for threshing and general haulage work.

No. 2 is a tractor of light type, weighing only 37 cwt. It is of 24 h.p. and is suitable for practically all work on the farm. Its weight makes it well suited for light, quick haulage, and it will drive a 5 ft. threshing drum. Ploughing with this tractor costs from 4s. to 4s. 6d. per acre according to the nature of the work.

No. 3 is a steam agricultural tractor weighing 4½ tons. The engine is a compound one, with side by side high and low pressure cylinders; the boiler (with 200 lb. working pressure per inch) is of locomotive type and will haul four furrows on stiff land. The tractor will cover 5 acres in the day and consume 1 cwt. of coal per acre. The following is the cost of working per day :—

	£	s.	d.
Depreciation, interest on capital and repairs, at 15 per cent. for 200 working days		6	0
Five cwt. of coal		6	0
Oil, &c.		1	0
Driver's wages		4	0
Ploughman's wages		3	0
	£1	0	0

This would work out at 4s. per acre.

* The working life would really be from 10 to 12 years, but 5 years are given to show the maximum cost.

It appears therefore that ploughing by mechanical means must be very much cheaper than by horse power. A further advantage of mechanical power is that there is no limit to the working hours and, if necessary, the work may be carried on throughout the night by the aid of a lamp. This is an important point, as by this means it is possible to make the best use of spells of fine weather.

Other Types of New Machinery.—A characteristic of modern farm machinery is the tendency to combine many different types of work in one machine. The cultivator is now also available as a ridging plough, horse hoe and grubber, with very little additional cost for attachments. With the addition of a seed box it may be utilised as a broadcasting machine. Until a few years ago combination implements and machines were looked upon with suspicion, but the mechanical principles now applied are much more efficient and the earlier failures are avoided.

One of the best examples of a complex machine in use on the farm is the combined clover thresher and cleaner. This machine performs many different kinds of work with perfection, and should be appreciated by all those who have used the separate threshing drum and rubber.

Another machine of great use to farmers is the seed cleaner, which has replaced the unsatisfactory methods of the seed cleaning floor and has assisted materially in raising the standard of purity of agricultural seeds.

Milking Machines.—Another branch of farming work which would benefit materially by the introduction of machinery is milking. For some years it has been increasingly difficult to obtain skilled milkers, and the present shortage in labour will make the problem a serious one unless the farmer can see his way to utilise the milking machine. Farmers will do well to overcome their former prejudices. The crude, early forms are now superseded and the later machines are much more efficient, and farmers may use them with the knowledge that they are more economical than hand milking. One of the chief objections to the older machines was that the impure air of the cowsheds was forced into the milk at each stroke of the pulsometer, with the result that the milk kept badly. This has been avoided in one machine now on the market, and many other objections have been removed in the later types of machines.

Mechanical power has also been applied to cream separating and it is now possible to obtain at a cost of £26 10s. a combined

separator and petrol engine on one stand. The separation is done by a $\frac{1}{2}$ h.p. engine, separating 70 gallons per hour at a cost of 1½*l.* The engine can also be used to work the churn.

The machines, to which attention has been called, not only do cheaper but better work than can be done by hand. They are, however, only a few of the really efficient labour-saving machines which are now available, and provided he can make use of them the farmer need have no apprehension as to the effect of any shortage of labour.

TECHNICAL ADVICE FOR FARMERS.

ALTHOUGH the English farmer has usually a wide and extensive knowledge of the ordinary principles of cultivation and breeding, cases constantly arise in which his experience may usefully be supplemented by the knowledge of the specialist who has made a study of some particular branch of agriculture. The most obvious example of this occurs in the treatment of diseases of plants, the nature of which cannot usually be identified by the farmer. Many of these diseases lead to serious losses, and it is only to the expert that the farmer can turn for reliable information as to their prevention or treatment.

At a time like the present, when the values of crops, manures and feeding stuffs have altered so greatly, when changes occur from week to week, when new machines and implements are required and when practices more or less unusual are being adopted, even experienced farmers may wish to have the benefit of the knowledge gained by others.

Many, for example, who do not usually manure their corn crops must be asking themselves whether, in view of the high prices now ruling, and the very wet weather of the winter and early spring, it would not be desirable to top-dress wheat and oats, or even barley, and would be glad to profit by the experience of those who habitually use such manures as sulphate of ammonia and nitrate of soda as a spring top-dressing.

Advice on agricultural matters, moreover, is needed not only by the experienced, but also by the inexperienced cultivator and by the small holder who may not always have that knowledge of the best agricultural practice which it is assumed the practical farmer possesses. There are many facts or methods which are still not matters of common knowledge,

although known and accepted by well-informed agriculturists. Among them may be mentioned the economic uses of manures and feeding stuffs ; the merits of particular strains of seeds ; and the manufacture of different types of dairy produce.

During the past few years the Board have given much attention to means of providing advice for agriculturists, and they are gradually organising a system by which it is hoped to provide full and accurate information for all who desire to avail themselves of it.

The system is one which will take a number of years to develop fully ; it is as yet in an early stage, and under ordinary circumstances it would have been preferable to delay reference to it until the arrangements were more complete ; but if properly utilised the system is already capable of providing much assistance for agriculturists, and in view of the present need for employing every possible resource, some account of it is desirable.

For the purposes of agricultural education, the Board have divided England and Wales into twelve groups of counties, each group constituting a " province." The aim has been to secure for each county a staff of competent instructors under a Chief Instructor or Organiser, and to provide for each province the services of a well-equipped University Department of Agriculture, or a College with a staff of expert teachers and investigators capable of undertaking consultative work in agriculture, and in such of the sciences as bear most directly on the work of the farmer.

Advice through the Staffs of Local Education Authorities.

In many counties in England and Wales, the Education Authorities have already appointed a county agricultural staff, the members of which are qualified to deal with enquiries relating to recognised agricultural practices. Wherever these appointments have been made the Organiser and his staff are now available for the purpose of supplying general advice on agricultural subjects, including dairying, horticulture and poultry-keeping.

In those counties in which a trained agriculturist is employed persons desiring advice should apply to him ; he will either deal with the subject himself or refer the enquirer to some specialist who can help him.

Advice through the Staffs of Universities or Colleges.

In eleven out of the twelve provinces above referred to, arrangements have already been made by which the members of the staff of a university or agricultural college are available

for advising agriculturists. Further, with the aid of a grant from the Development Fund, in nine out of these eleven institutions the staff has been specially strengthened by the addition of one or more officers, known as Advisory Officers.

The special business of the Advisory Officer is to deal with enquiries, endeavour to ascertain the subjects within the province that require special study, investigate, or arrange for the investigation of, these subjects, keep in touch with the progress of agricultural research, and endeavour to ensure that new scientific discoveries do actually benefit the farmers of the province. The name "Advisory Officer" was selected as being a convenient one to distinguish the new members of staff, provided for by a grant from the Development Fund, from others members of the college staff. But while the Advisory Officer is specially charged with the duties above indicated, it should be clearly understood that he is only one of a group of trained men engaged in studying agricultural questions and assisting in providing advice for agriculturists.

It is everywhere recognised that the subjects now embraced under the general term "Agricultural Science" are much too wide to be properly dealt with by one man. Instead of the "consulting chemist" of last century, who answered, or was expected to answer, questions on every scientific subject, there must now be a group of specialists. The only method of securing efficient help is by a system of division of labour which requires every member of the staff of an agricultural college or university department to do his share. Neither the County Organiser nor the College Advisory Officer has any monopoly in the giving of advice, for both are charged with this duty, and the business of each is to see that the enquirer, whether small holder or large farmer, gets the best possible information which may be available.

In those counties in which no Organiser or other trained agriculturist has been appointed, questions should be addressed to the Provincial College.

Research Institutes.

Attention may be directed to another group of institutions which, although established for a different purpose, are of the greatest possible value in the scheme for providing advice now under notice.

Research Institutes are institutions set up, or assisted, by grants from the Development Fund for the purpose of making a careful study of certain groups of agricultural

subjects. For example, the existing station at Rothamsted was enlarged, and now studies questions bearing on the fertility of soils in a more comprehensive way than was possible formerly; at Cambridge a new Institute has been formed for studying the feeding of animals; the Board have recently fitted up at Kew a new Institute for studying plant diseases; another Institute is now being erected by them at Addlestone, Surrey, for investigating the diseases of animals; at Bristol there is an Institute giving special attention to fruit, and other horticultural questions; at Cambridge there is an Institute for breeding new crops. The whole subject "Agricultural Science" has in this way been divided up into sections, on which eleven Institutes are already at work. The information provided through these Institutes will reach agriculturists through the staffs of universities, colleges and counties, as well as directly through publications.

Live Stock Officers.

In connection with the scheme for the improvement of live stock, an officer has been appointed by the agricultural colleges in the same way as the agricultural advisers above referred to. These officers will be primarily responsible for the local promotion and administration of the Live Stock Scheme in their respective areas,* but they will also be required to give technical advice and assistance to local agriculturists, and to members of the county staff on questions relating to live stock.

Forestry Advisers.

England and Wales have been divided into five districts, and an expert forester has been attached to a teaching institution in each district for the purpose of advising applicants on all questions relating to the treatment of their woods. In certain circumstances the teaching institution may charge for this advice a fee not exceeding one guinea a day. Since there are only five Forestry Advisers it has not been possible to adhere to "province" boundaries.

Summary of Arrangements for Advice.

From the foregoing particulars it will be seen that the arrangements made by the Board contemplate, for all branches of the agricultural industry:—

(1) The supply of ordinary information and advice through

* See Leaflet No. 282 (*Associations for the Breeding and Improvement of Live Stock*), printed at p. 46.

the County Organiser on the general principles and practice of agriculture.

(2) The supply of advice on more difficult matters, and the investigation of local problems through the medium of expert advisers and other members of a college staff.

(3) Scientific research on agriculture and on diseases of plants and animals, with the object of improving the quality of the information available for agriculturists.

Each of these parts of the complete organisation is intended to supplement the others and to prevent waste of time and energy.

Information Supplied by the Board.

In cases in which difficulty may be experienced in getting advice locally the Board are prepared to advise on agricultural questions, and on the treatment of insect and fungus pests, but in view of the importance of local knowledge in dealing with most agricultural questions it is desirable that reference should, wherever possible, be made to the County Organiser or other agricultural instructor.

NOTE.—The foregoing article has been issued in leaflet form, and contains a schedule showing the name of the Agricultural Organiser or other officer in each county to whom enquiries may be sent, together with the addresses to which enquiries for the College Advisory Staff should be forwarded. The arrangements are not in all cases complete, and further appointments are being made as opportunity offers. In those cases where no Agricultural Organiser is shown enquiries should be addressed direct to the College. The leaflet may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

DANISH INVESTIGATIONS SHOWING HOW TUBERCULAR FOWLS INFECT PIGS.*

JOHN J. DUNNE.

Fyns Sprogskole, Odense, Denmark.

UNTIL quite recently it was generally assumed that tuberculosis was either transmitted to pigs by feeding them with the milk, or unpasteurised whey, obtained from tubercular

* Translated from the 28th Report of the Serum Laboratory of the Royal Danish Veterinary and Agricultural High School, Copenhagen. 28de. Meddelelse fra den kongelige danske Veterinær og Landbohøjskoles Serumlaboratorium, København.

cattle, or was conveyed through the natural excrement of such cattle.

During recent years, however, close observation of several isolated cases of tuberculosis has indicated that pigs may be infected with the tubercular disease affecting poultry and birds in general—*i.e.*, avian tuberculosis—and extensive investigations made by competent veterinary surgeons have now confirmed this view.

It may be mentioned at this stage that avian tuberculosis is chiefly abdominal; and the tubercles, in the form of yellowish white nodules, from the size of a grain of millet seed to that of a pea, may be observed in the liver, in the spleen, or in the mesenteric glands of the fowls.

At the beginning of May, 1912, Mr. Axel Petersen, Veterinary Surgeon, Ringsted, sent the mesenteries and internal organs of three pigs, belonging to the same herd, to the Danish State Laboratory for examination. The examination showed the liver, lungs and mesenteric glands to be tubercular, and it was found that bacteria from the mesenteric glands were identical in every respect with avian tubercular bacteria.

In order to throw further light on the matter seventeen cases of swine tuberculosis were investigated. Of these, in five cases the disease existed in the mesenteric glands and tonsils only, while in the remaining twelve the disease was more or less general. The results of the investigations revealed that nine of the animals were infected with avian tubercular bacteria (either exclusively or along with bovine tubercular bacteria), and the other eight exclusively with bovine tubercular bacteria. The five cases in which the disease was limited to the mesenteric glands and tonsils were found to be exclusively infected with avian tubercular bacteria, while the bovine tubercular bacteria were found in the cases in which the disease was general.

It was then decided to extend the investigations to a much larger number of cases from different parts of the country. The State Agricultural Laboratory requested several swine slaughtering companies to arrange for their veterinary assistants* to isolate and send to the Laboratory whatever tubercular mesenteries or tubercular tonsils came to their notice. In the course of time the Laboratory received a large number of the diseased organs, chiefly representing cases of tonsillar tuberculosis only, from different parts of Denmark. These diseased organs were carefully isolated; those of each animal

* Danish law requires an efficient veterinary surgeon to be on the staff of the slaughtering company.

were packed up separately and forwarded to the Agricultural Laboratory accompanied by information as to the extent of the disease amongst the animals on the farm from which the tubercular case originated, the age of the tubercular animal and the owner's name and address.

On examining the organs of a total of 118 tubercular pigs it appeared that 86 of them contained bacteria identical in every detail with avian tubercular bacteria, 28 contained bovine tubercular bacteria, and in the remaining 4 cases the bacteria deviated in form from both types, but in two cases closely resembled the avian type.

The results of the foregoing examinations show that the character of the disease varies in accordance with the type of tubercular bacteria by which the pig is attacked. An attack of avian tubercular bacteria is usually of a local character, while that of bovine tubercular bacteria is of a general character.

In order to investigate the conditions under which the disease may be transmitted from poultry to pigs the State Agricultural Laboratory applied to the owners, whose swine were found to be attacked by avian tubercular bacteria, for detailed information as to the health of their poultry and the extent to which they had come into contact with the pigs. Forty-nine owners furnished reports. Of these, thirty-six stated that tuberculosis amongst their poultry was general, and post-mortem examinations of fowls from fourteen owners confirmed this; in the remaining cases the owners failed to send dead hens for examination, but gave instead such detailed information of the character and progress of the disease as to leave no room for doubt with regard to its identity.

As for the remaining thirteen owners, they reported that there did not appear to be any particular disease prevalent amongst their poultry, although one or another of the fowls died occasionally. It was impossible to decide from their replies whether tuberculosis existed or not, but it should be borne in mind that the absence of any great mortality amongst poultry does not preclude the possibility of the existence of tuberculosis. The disease is slow in its development, as a rule, and infected poultry might remain unnoticed for a long period and yet be virulent infective agents. As avian tuberculosis establishes itself chiefly in the alimentary tract, the excrement of the tubercular fowls is highly contagious. The unsatisfactory character of the information furnished by the thirteen owners in question may have been due partly

to an insufficient acquaintance with the nature of the disease, but it may also have resulted in some measure from the fact that they did not wish it known that their poultry were tubercular. In any case the poultry could not be considered free from tuberculosis simply because the State Laboratory failed to establish the existence of the disease.

The conditions under which poultry and pigs were kept on many of the farms rendered it almost impossible to prevent infection of the pigs from tubercular poultry. In some cases the hen-roost was situated directly over the pig-sties, without any intervening boards to catch the droppings, so that the pigs had unlimited opportunity to eat the excrement of the fowls. In other cases the fowls were only allowed to roost over the sties during the winter season. In these circumstances it would be nothing short of a miracle for the swine to escape infection.

On most farms it is the custom to allow the young pigs to run with the poultry during the greater part of the summer, either in an enclosed yard or on a free range. This practice also contributes to the spread of the disease.

A number of owners stated that the poultry and pigs were kept quite separate, and that they could not understand how the disease was transmitted. These owners, like the thirteen already referred to, are unacquainted with the nature of the disease. Even the impossibility of all direct contact between the poultry and pigs does not preclude the transmission of the disease from tubercular poultry indirectly. The bacteria in the droppings of diseased fowls remain potent for a long period, either in the manure heap or in the soil, and the pigs while rooting around might readily become infected. Another probable source of contagion is from pigs bought at fairs or markets and added to the existing stock; such animals may come from farmsteads where tuberculosis exists, and, being infected when bought, may transmit the disease to the buyer's stock. The disease may also be transmitted by rats or mice.

On the whole the results of the investigations show that the overwhelming majority of the cases of mesenteric tuberculosis are of a local character and almost exclusively due to avian tubercular bacteria.

The Laboratory also ascertained the number of cases of swine tuberculosis that occurred during 1912 amongst the animals of those owners whose poultry were ascertained to be tubercular, but as nothing is known of the health of the

cattle belonging to these owners it would not be fair to quote the figures. The following cases of tuberculosis which have occurred at Remkolde, where bovine tuberculosis no longer exists, are, however, on a different footing, and may be entirely attributed to contagion from tubercular fowls.

Table showing number of tubercular swine found on five farms where the poultry were tubercular and the cattle free from bovine tuberculosis and inoculated bi-annually.

		Number of pigs delivered during 1912.	Number of these found to be tubercular.	Percentage of tubercular animals. %
Owner A ...	...	29	6	21 ⁰ / ₁₀
" B ...	...	24	4	17 ⁰ / ₁₀
" C ...	...	22	4	18 ⁰ / ₁₀
" D ...	...	49	3	6 ⁰ / ₁₀
" E ...	...	39	14	36 ⁰ / ₁₀

The above figures indicate the necessity for taking drastic measures to eradicate avian tuberculosis. The percentage of tubercular cases in the above table is unusually high, and although the disease in most cases was not of an acute form, a pecuniary loss resulted to the owner in every case, owing to the stringent Danish regulations as to the movement of, and the sale of meat* from, tubercular animals, however slightly tainted by the disease.

In two cases where the existence of avian tuberculosis amongst the swine was detected, the owners dis-infected the sties and the hen roosts and carefully isolated the animals, with the result that the swine reared under the new conditions were found to be entirely free from the disease. Prior to taking these precautions, two or more animals in every lot were found to be suffering from tuberculosis; but no cases have occurred since the isolation took place. It appears, therefore, that the infection of pigs with avian tuberculosis can be prevented most effectively by isolating the pigs and the poultry, and taking drastic measures for the eradication of the disease amongst the latter.

* Tubercular meat, however slightly tainted, is rigidly excluded from export.

A GRANT for the purpose of improving the live stock of England and Wales was made to the Board from the Development Fund in 1913. The amount available was approximately £40,000, and it is anticipated that similar grants will be made for some years to come. The grant is intended to enable the Board to assist groups of farmers, especially the smaller farmers, to obtain the use of high-class bulls, stallions and boars instead of the inferior sires which are very generally employed at present. The Board will also be enabled to pay one-half the expenses (up to a certain maximum) of associations of farmers who undertake to keep milking records of their cows.

**Associations for the
Breeding and
Improvement of
Live Stock.**

In order to impress upon farmers the advantages of co-operation in securing the services of good sires, grants in respect of stallions and boars will be made only to clubs and societies. The same procedure will also be followed wherever possible in the case of bulls, but in districts where bull societies cannot be formed, grants will also be made to individual breeders who are willing to place approved bulls at the disposal of their neighbours.

Grants will be made preferably to societies specially formed to take advantage of the scheme, provided that they adopt rules which conform substantially to those issued by the Board, but grants may also be made to existing bull, stallion and boar societies on condition that their rules are amended where necessary. Registration of societies (under the Industrial and Provident Societies Act or the Friendly Societies Act) is not essential.

Preference will be given by the Board, in the assistance offered, to occupiers of agricultural holdings, which either do not exceed 100 acres in extent, or if exceeding 100 acres, are of an annual value for purposes of income tax not exceeding £100.

A further advantage to farmers under this scheme is that they will be able to obtain practical advice and assistance on questions relating to live stock from the Live Stock Officers, who have been appointed by the selected agricultural institutions for the purpose of promoting the Live Stock Scheme in England and Wales.

The following are some of the more important conditions on which the grants for the provision of bulls, stallions and boars, and the grants to milk recording societies will be made.

Grants for Bulls.—Grants for the provision of bulls will be made on the following conditions :—

(1.) No grant exceeding £12 per annum is to be made to any individual bull owner, or exceeding £15 per annum to any society in respect of any one bull.

(2.) Not more than four annual grants of £12 are to be made to any individual; and not more than five annual grants of £15 to any society for each approved bull provided by it.

(3.) Grants are only to be made to individuals when the Live Stock Officer in the area concerned is satisfied after full inquiry that it is not possible to form a bull club for a district in which the provision of a good bull is necessary.

(4.) No grant is to be made to any individual in respect of a bull previously owned by him unless the Live Stock Officer is satisfied that in return for the grant the bull can and will be made available for an appreciably greater number of cows belonging to small farmers than it now serves.

A society may provide a bull for the use of its members—

(a) By purchasing a bull and placing it in the custody of one of its members; or

(b) By arranging with an owner of a bull—whether he be a member of the society or not—to place a bull at the disposal of the society on terms agreed between them.

If a society arrange to purchase a bull, it will be necessary to provide, by means of contributions from members or donations to the society, sufficient capital to defray the cost of the purchase of the bull, and also an annual income sufficient to cover the insurance and keep of the bull, the salary of the secretary of the society, the general expenses of management, and sinking fund charges in respect of the depreciation of the bull sufficient to provide for the replacement of the bull when necessary.

If a society arrange with an owner of a bull to place a bull at their disposal they must guarantee the service of not less than 25 cows belonging to their members.

The owner of a bull will be entitled under these circumstances (1) to a payment from the society of a sum not exceeding £12 as may be agreed upon, (2) to a fee of not less than 2s. 6d. for each cow served, and (3) to have not more than 15 of his own cows served by the bull.

If a society arrange for the provision of a bull in this manner, the grant of £15 made to them by the Board, together with a nominal subscription of say 1s. per member, would probably

suffice to defray all expenses, as the owner of the bull and not the society will be responsible for the keep, insurance, and care, &c., of the animal.

Grants to Heavy Horse Societies.—Grants will be made on the following conditions to heavy horse stallion societies which hire stallions :—

(1.) No grants will be given to societies which hire stallions to travel at a fee exceeding £3 3s.

(2.) In no case will the grant to a society exceed £80 for each approved stallion provided by it, of which not more than £40 may be a direct grant, the remainder being utilised, if necessary, for “assisted nominations.”

(3.) Except in the case of “assisted nominations” no reduction in the amount of the service fee usually charged is to be made by the societies receiving grants.

(4.) The stallions hired by societies receiving grants must be registered under the Board’s scheme for the registration of stallions ; and the mares for which assisted nominations are given must be approved by the society as suitable for the purpose.

The value of an assisted nomination is not to exceed half the amount of the service fee.

Grants for Boars.—Grants will be made to societies only.

The amount of the grant for a boar will be £3 per annum.

A society may provide a boar for the use of its members :—

(a) By purchasing a boar and placing it in the custody of one of its members ; or

(b) By arranging with an owner of a boar—whether he be a member of the society or not—to place a boar at the disposal of the society on terms agreed between them.

If a society arrange to purchase a boar it will be necessary to provide, by means of contributions from members or donations to the society, sufficient capital to defray the cost of the purchase of the boar, and also an annual income sufficient to cover the insurance and keep of the boar, the salary of the secretary of the society, the general expenses of management, and sinking fund charges in respect of the depreciation of the boar sufficient to provide for the replacement of the boar when necessary.

If a society arrange with an owner of a boar to place a boar at their disposal, they must guarantee the service of not less than 20 sows belonging to their members.

The owner of a boar will be entitled, under these circumstances, (1) to a payment from the society of a sum not

exceeding £3 per annum as may be agreed upon; (2) to a fee of not less than one shilling for each sow served; and (3) to have not more than 6 of his own sows served by the boar.

If a society arrange for the provision of a boar in this manner, the grant made to them by the Board, together with a nominal subscription of say 6d. per member, would probably suffice to defray all expenses, as the owner of the boar and not the society will be responsible for the keep, insurance and care, &c., of the animal.

Grants to Milk Recording Societies.—Grants will be made annually to societies whose members record the milk yields of their dairy cows not less frequently than once a week, and who employ a recorder to pay surprise visits to check, at least once every six weeks, the records taken. The amount of the grant will be half the expenses of the society up to £50 in respect of each whole-time recorder employed for every 20 herds in the possession of members of a society.

Further information as to milk recording societies, together with the text of the model rules and regulations issued by the Board, will be found in Leaflet No. 146 (*The Value of Records of the Milk Yield of Cows*).

NOTE.—A society or private individual desiring a grant under this scheme should address the application to the Live Stock Officer for the province in which the society or individual is located.

Detailed information as to the Board's scheme for improvement of live stock, and copies of the Board's model rules and regulations as to the award of grants to bull, boar, heavy horse and milk recording societies may be obtained, free of charge, on application to a Live Stock Officer or to the Secretary, Board of Agriculture and Fisheries, Craven House, Northumberland Avenue, London, W.C.

The foregoing article has been published in the form of a Leaflet (No. 282) of which copies may be obtained free of charge, and post free, on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W. The Leaflet contains a list of institutions, the counties served by them, and the names of Live Stock Officers to whom enquiries for information as to the working of the Scheme in the respective provinces can be addressed.

It is only within comparatively recent years that the small moths known as "larch-shoot moths" have been recognised as a source of injury to larch in this country. They are now known, however, to be widely distributed, and under certain conditions, which will be dealt with subsequently, are capable of causing serious loss.

**Larch-Shoot
Moths.**

The species occurring in England is usually known as *Argyresthia atmoriella*, though in the edition of the Board's leaflet, No. 208, of February, 1909, it was referred to as *Argyresthia laevigatella*, a Continental form not recognised with certainty as British. There is also an insect known on the Continent as *Argyresthia zelleriella*. These three names refer to moths with similar habits, but whether they should be regarded as a single species remains to be decided. The question is not of great importance from the forestry point of view, but at the same time it should not pass unnoticed, since these insects may be mentioned in literature under any one of the three names, a possibility apt to lead to confusion.

Description of Insect.

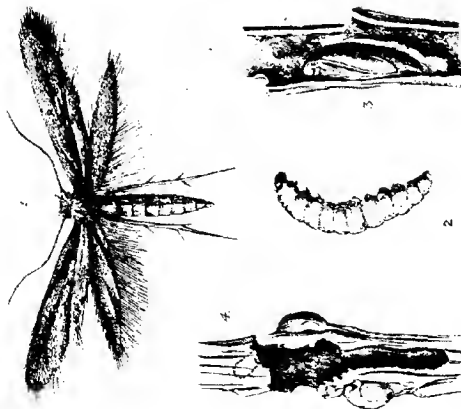
Adult Insect.—The moth measures about $\frac{1}{5}$ in. in length and about $\frac{3}{8}$ in. in spread of wings. Its general appearance when magnified is shown by Figure 1. The colour is leaden grey, the fore-wings having a distinct metallic gloss, while the hind wings are darker and without the gloss.

Larva.—The larva of *A. atmoriella*, when full grown, measures from $\frac{1}{5}$ – $\frac{1}{4}$ in. in length and is shown, much magnified, in Figure 2. It has a black head and the body is either greenish or yellowish in general colour.

Pupa.—The form of the pupa is shown by Figure 3, which illustrates a specimen in position in a larch shoot. It is pale ochreous brown in colour.

Life History.

The moths appear at the end of May or early in June and lay their eggs on the young shoots, one egg as a rule being placed on each shoot. On hatching, the young larva bores its way through the cellular skin, under which it begins to feed. At first, owing to its small size, it does little damage, and the shoot is not sufficiently injured to prevent a normal development. As the larva grows it enlarges its burrow, causing



LARCH-SHOOT MOTH (*Agryvashita abnoveella*).
 FIG. 1. —Moth (magnified). FIG. 2. —Larva (much magnified).
 FIG. 3. —Pupa. FIG. 4. —Form of Burrow.

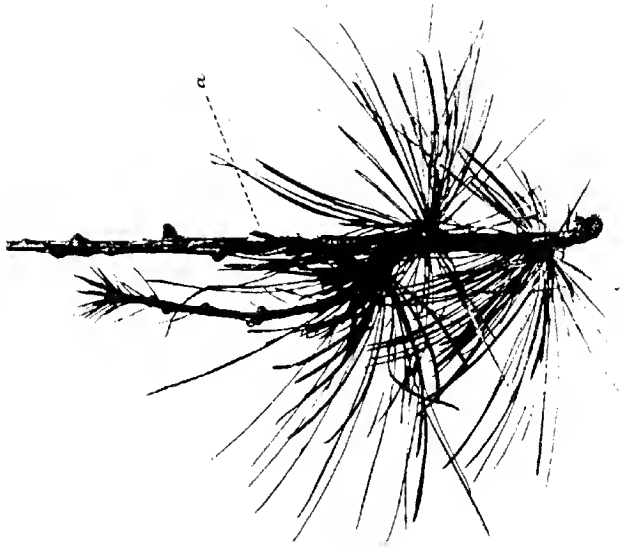


FIG. 5. —Branch of Larch attacked by Larch Shoot Moth.
 (a) Portion tunnelled by Larva.

more damage to the shoot, and by the end of March or beginning of April it has devoured the tissues right down to the wood, forming a tunnel which may be roughly described as an incomplete spiral,—that is to say, the shoot is almost if not completely ringed. The general form of the burrow is shown by Figure 4, which represents an attacked shoot, much magnified, from which the bark has been removed in order to show the workings of the larva underneath. The dotted lines indicate the continuation of the burrow on the under side of the twig. In May the larva is full fed and it then bites a small hole through the bark from which the moth will ultimately escape. This flight hole and a portion of the burrow are covered by a thin web and the larva then pupates, as is shown by Figure 3. On emerging the moth forces its way out through the silk covering over the hole, the empty pupa skin remaining in the burrow.

Plants Attacked and Nature of Damage.

The plants attacked by the pest comprise only those of the genus *Larix*, but whether, or to what extent, species other than the European larch are affected, is not at present known.

The nature of the damage is fairly obvious from the preceding description of the life history. The attacked twigs are almost ringed at the end of their first year and must naturally die, though a few needles may be produced from the lower portion near the flight hole. As a rule the leading shoot is not attacked, but in severe cases this may also occur. Diagnosis of an attack is not always easy, though the absence of needles on the lateral branches gives the tree a characteristic appearance. Dead shoots which have not been attacked by the insect are often numerous on larch, and the presence of the pest must always be confirmed by the discovery of larval burrows. Small birds seem to have no difficulty in recognising tenanted shoots, which they break open in order to obtain the larvae, and the traces left by the birds are often the most noticeable indication of an attack. Figure 5 represents an attacked branch, letter *a* indicating the region tunnelled by the larva of the *Argyresthia*. The branch is of interest as showing the development of a secondary shoot to replace that killed by the pest. It is, however, somewhat deceptive, as it appears to be a leading shoot, whereas in reality it is a lateral.

Distribution and Economic Importance.

As regards the economic status of the insect, though it appears to exist wherever larch is grown, observations show that it is chiefly destructive in localities not altogether suited to this tree. It must probably be regarded therefore as one of those minor pests which only become of serious importance in plantations enfeebled by other pests, by bad culture, or by an unsuitable environment.

Methods of Control.

The preceding notes show that this pest is best controlled by restricting the planting of larch to localities suited to it.

No treatment can be suggested in the case of an extensive attack, but when a few trees only are affected in an otherwise sound plantation it would be a wise precaution to remove the attacked trees and burn the lateral branches. In the case of single trees of special value or in the nursery it might prove feasible to remove only the attacked twigs. This must be done as soon as failure of the twigs to produce needles in the spring shows that they have been attacked.

THE following notes on feeding stuffs have been prepared at the request of the Board by the School of Agriculture, Cambridge University. The values are based on the approximate prices of the various feeding stuffs at London, Liverpool, Hull and Bristol at the beginning of April.

The high prices of feeding stuffs, and the difficulties of transport, caused by disturbances due to the War, entail a very considerable amount of study on the part of the "feeder," who, looking for the most profitable results, wishes to fulfil the duty of increasing the national food-supply.

Food Constituents.—The skill of the chemist has enabled him to arrange all food constituents in groups, among which the following are very important: (1) Flesh-formers (called albuminoids or protein); (2) Carbohydrates (material used as fuel in the animal's body); and (3) Oil or Fat (a material which adds greatly to the value of milk and meat as human food, when stored as reserve concentrated fuel in the tissues of the "finished" animal). It should be fully realised that whereas fat can replace carbohydrates and carbohydrates can replace fat, neither the one nor the other nor both together can replace flesh-formers. Hence the importance of paying attention to the first column in the table on p. 55. Here, under the title

"Nutritive ratio," is stated the relative proportion of flesh-formers to fuel and fat. For instance, in the case of soy bean cake each 1 lb. of flesh-former is combined with $1\frac{1}{10}$ lb. (1 : 1.1) of fuel and fat (the fat being reduced to its full fuel value), whereas in the case of palm-nut cake 1 lb. of flesh former is combined with 4 lb. (1 : 4) of fuel and fat. This nutritive ratio should always be kept in mind when examining the cost of a feeding stuff.

*Food Units.**—For the purpose of comparing the value of one food with another chemists have sought to reduce everything digestible to one common factor, so that foods may be compared with one another. The chemist would be the last person to claim that this valuation is complete, and the matter is still being very closely investigated by scientific workers. Nevertheless, the results so far obtained are much too valuable to be ignored. A feeder may feel quite safe in allowing himself to be guided largely by them, provided always he pays attention to the following matters incidental to their *practical* worth.

Wholesomeness.—Occasionally the food unit value of a food is upset by the presence of some poison, but this is of very rare occurrence. At the same time, when circumstances suggest the desirability of using some feeding stuff that is new to the market it is undoubtedly desirable to bear the question of poisonous substances in mind.

Apart altogether from the presence of poisonous properties, experience suggests that stock thrive better on certain foods than on others. Linseed cake, oats and bran immediately suggest themselves to the mind as foods which are believed to be perfectly wholesome. The skill of the feeder must decide how much he ought to pay for the quality of wholesomeness. For instance, if the table on p. 55 be consulted the food unit of oats will be found to vary in cost from 2s. 11 $\frac{1}{4}$ d. to 3s. 3 $\frac{1}{4}$ d., whereas that of maize germ meal lies between 1s. 7 $\frac{3}{4}$ d. and 1s. 8 $\frac{1}{2}$ d. The difference in the nutritive ratio is very slight, so that unless experience shows in no uncertain way that oats, in their effect on the health of the feeding beast, are quite different from maize germ meal, the former is a very much dearer food at present prices.

Prejudice.—In studying food unit values the feeder will do well to watch for any accidental cause that may have led to feeders disliking some particular foodstuff. For instance, decorticated cotton cake is disliked by many because, before knowledge about nutritive ratios was as common as it is now,

* Calculated by the formula protein $\frac{9}{100} \times 2\frac{1}{2} + \text{fat } \frac{9}{100} \times 2\frac{1}{2} + \text{carbohydrates}$
% = food units per ton. (See Leaflet No. 74, p. 8).

it was fed in far too large quantities. Again, if maize be *substituted* for beans the result will be likely to be bad, whereas a *mixture* of maize and decorticated cotton cake would probably be successful in replacing beans as a fattening food.

Palatableness.—It is clear that stock exhibit preference in regard to food, but this preference should not be allowed to become too costly. The unrelished food should be given at the beginning rather than at the end of the feeding period. Its palatability can be increased by skilful mixing, by the addition of some little condimental food, and even by adding a little common salt.

Change of Feeding Stuffs.—Much of the prejudice which exists against the wholesomeness, the palatability, etc., of certain foods, is due to neglect of the elementary rule that all change in feeding stock should be gradual. This precaution is all the more important if foods differing greatly in their nutritive ratio are being substituted one for the other.

Convenience.—No practical feeder can neglect the matter of convenience, which is still more important when labour is short. Generally speaking, cake is more convenient to feed than meal, but experience of the special circumstances existing in each case must decide how much should be allowed for convenience in the cost of a feeding stuff.

Appearance.—Probably the pleasing appearance of a food is sometimes paid for. This indeed seems to be the case when the prices of the two wheat brans given in the table are compared, "broad" bran costing from 1s. 9½d. to 2s. 0½d. per food unit as against 1s. 7½d. to 1s. 10½d. for simple bran. Many practical men, who observe things for themselves, refuse to pay the extra money, however much more pleasing may be the appearance of the one compared with the other.

Markets.—The study of the table on p. 55 shows that locality may have a great effect on the cost of each food unit fed. For instance, oats cost 2s. 11½d. at Hull and 3s. 3½d. at Bristol. If it may be contended that such a difference may be due to the special quality of a sample from the one or other locality, it can hardly be maintained that (see table) peas from Liverpool at 3s. 2½d. per food unit are as good value as peas from Hull at 2s. 6½d.

Remarks on Use of Feeding Stuffs.

The chief points in the feeding of the foodstuffs dealt with in the table are given below, and should be read in conjunction with the Special Leaflets Nos. 8, 16, 19 and 20 already issued by the Board. It is assumed that the usual allowance of roots and bulky fodder is fed.

Table of Feeding Stuffs, showing Nutritive Ratio, Food Units, Price per Ton and Price per Food Unit.

Feeding Stuff.	Recensed from digestible nutrients.		Approximate price per ton at the beginning of April.				Approximate price per Food Unit.			
	Nutritive Ratio.	Food Units.	London.	Liverpool.	Hull.	Bristol.	London.	Liverpool.	Hull.	Bristol.
Soya Bean Cake ..	1:1.1	125.3	6 15 0	6 15 0	6 2 6	8 7 6	5 4 0	5 4 0	5 4 0	5 4 0
Deodorized Cotton Cake ..	1:1.3	123.1	9 10 0	9 10 0	10 2 6	8 17 6	4 4 0	4 4 0	4 4 0	4 4 0
Indian Linseed Cake ..	1:1.5	120.1	10 10 0	10 10 0	10 15 0	11 7 6	1 6 0	1 6 0	1 6 0	1 6 0
Bombay Cotton Cake ..	1:2.0	95.3	10 15 0	11 15 0	10 15 0	6 10 0	1 11 0	1 11 0	1 9 0	1 10 0
Egyptian Cotton Cake ..	1:2.4	87.3	6 15 0	7 0 0	6 15 0	6 15 0	1 11 0	1 11 0	1 11 0	1 10 0
Groundnut Cake ..	1:2.8	103.6	7 2 6	7 15 0	7 0 0	6 15 0	1 6 0	1 6 0	1 6 0	1 6 0
Groundnut Kernel Cake ..	1:4.0	83.5	6 15 0	6 5 0	9 0 0	—	1 10 0	1 10 0	1 5 0	—
English Beans ..	1:2.6	99.5	10 15 0	10 15 0	10 15 0	—	2 3 0	2 3 0	2 3 0	—
Chinese Beans ..	1:2.9	102.2	12 13 0	13 11 0	12 5 0	—	2 3 0	2 3 0	2 3 0	—
English Harp Beans ..	1:3.2	97.2	11 10 0	13 11 0	10 5 0	—	2 3 0	2 3 0	2 3 0	—
Calcutta White Peas ..	1:2.3	97.3	8 15 0	8 15 0	8 15 0	—	1 10 0	1 10 0	1 8 0	—
Argentine Maize ..	1:1.1	93.2	8 15 0	8 15 0	7 18 0	8 3 0	1 10 0	1 10 0	1 8 0	—
Calcutta White Peas ..	1:1.1	86.4	8 15 0	8 15 0	9 2 6	8 10 0	1 10 0	1 10 0	1 8 0	—
Argentine Maize ..	1:1.3	121.6	8 15 0	8 15 0	8 10 0	8 10 0	1 10 0	1 10 0	1 8 0	—
English Peas ..	1:1.4	87.0	9 16 0	9 16 0	8 10 0	8 10 0	1 10 0	1 10 0	1 8 0	—
Maize Gluten Meal ..	1:3.3	75.4	11 12 0	11 12 0	11 3 0	11 3 0	2 11 0	2 11 0	2 11 0	3 3 0
English Peas ..	1:2.9	75.4	11 12 0	11 12 0	10 15 0	11 3 0	2 11 0	2 11 0	2 11 0	3 3 0
Argentine Maize ..	1:2.9	80.9	7 0 0	7 0 0	6 10 0	6 10 0	1 8 0	1 8 0	1 6 0	—
Malt ..	1:3.4	21.1	1 7 0	1 7 0	1 0 0	1 0 0	—	—	—	—
Brewers' Grains (dried) ..	1:3.4	28.7	2 10 0	2 10 0	2 3 6	2 3 6	1 10 0	1 10 0	1 8 0	—
Barley ..	1:10.3	78.7	6 10 0	6 12 6	7 5 0	7 5 0	1 10 0	1 10 0	1 8 0	—
Barley ..	1:10.3	78.7	6 10 0	6 12 6	7 5 0	7 5 0	1 10 0	1 10 0	1 8 0	—
Wheat Middlings ..	1:5.3	86.3	6 7 6	6 12 6	7 5 0	7 5 0	1 10 0	1 10 0	1 8 0	—
Wheat ..	1:5.3	77.5	6 5 0	6 12 6	7 5 0	7 5 0	1 10 0	1 10 0	1 8 0	—
Wheat Bran (broad) ..	1:4.7	79.9	6 5 0	6 12 6	7 5 0	7 5 0	1 10 0	1 10 0	1 8 0	—

Soya Bean Cake.—Nutritive value, 1:1.1. Cost per food unit, 1s. 4½d.

The soya bean and its products are highly esteemed in the East for both man and beast. Owing to their comparatively recent introduction to this country, their practical value is not fully known. The cake is rich in protein, but possesses *distinctly* laxative, not to say scouring, properties. It should, therefore, be fed with great discretion, and it is suggested that it should never exceed one-fourth of the concentrated ration. At present prices it is a very cheap foodstuff, and should form an efficient substitute for part of the linseed cake in a ration. It can be mixed without danger with maize gluten feeds and a combination of bean and rice meal. It is usually fed in combination with common cotton cake. Further information is given in Special Leaflet No. 8.

Decorticated Cotton Cake.—Nutritive value, 1:1.3. Price per food unit, 1s. 6d.

This is the cheapest of the cakes in common use, probably because its use was abused when it was first introduced. It is a valuable feeding stuff, but should be fed with discretion, and should never exceed one-half the concentrated part of the ration. It goes well with maize (2 decorticated cotton cake, 4 maize), barley meal (2 decorticated cotton cake, 4 barley meal), maize germ meal, and a mixture of rice meal and bean meal (1 decorticated cotton cake, 1 bean meal, 2 rice meal).

Linseed Cake.—Nutritive ratio, 1:2. Price per food unit, 1s. 9½d.

This is held to be the most wholesome of all the cakes, and is especially esteemed for finishing fattening cattle. It may be mixed with anything so long as the mixture used does not lead to scouring. It is generally used in conjunction with cotton cake, bean meal, or a mixture of cotton cake and bean meal.

Common Cotton Cake.—Nutritive ratio, 1:2. Price per food unit, 1s. 11½d.

Both Egyptian and Bombay cotton cakes are in common use, being often mixed with more laxative concentrated foods owing to the binding properties they are known to possess. The Bombay cotton cake is apt to contain a lot of fibre, and is, therefore, dangerous for calves and lambs. Generally speaking, cotton cake is a better food for mature animals than for young growing stock. At present prices per ton Egyptian is cheaper than Bombay for feeding purposes.

Coconut Cake.—Nutritive ratio, 1:3.8. Price per food unit, 1s. 5½d.

This cake is of comparatively recent introduction into this country. Per food unit it is a comparatively cheap food, and is esteemed on the Continent for dairy feeding, and may be fed in quantities up to 3 to 4 lb. a day, being damped before use. At present prices it might be used as a substitute for more expensive foods in the concentrated rations for dairy cows, and should certainly be given further trial for feeding for meat production. Further information is given in Special Leaflets Nos. 8 and 20.

Palm-nut Kernel Cake.—Nutritive ratio, 1:4. Price per food unit, 1s. 7d.

This food is dearer per unit on some markets than coconut cake. It is very similar to coconut cake, and may be substituted for it.

English Beans.—Nutritive ratio, 1:2.6. Price per food unit, 1s. 11d.

Beans are much cheaper per food unit than the cereal grains, and may be fed to advantage in conjunction with any laxative concentrated food. Beans should be used with discretion as they are very binding. With linseed cake they form a very popular finishing ration.

English Peas.—Nutritive ratio, 1:3.2. Price per food unit, 2s. 7d.

Peas may be used for all purposes for which beans are fed, and have similar feeding properties. At the present ruling prices, peas are dear per food unit, and on this account should not be fed if beans are available.

Calcutta Peas.—Nutritive ratio, 1:2.3. Price per food unit, 3s.

These peas differ from English peas chiefly in having a higher protein content. Compared with English peas, they are dearer per unit, and their use is inadvisable in the present state of the market.

Maize.—Nutritive ratio, 1:11. Price per food unit, 1s. 9½d.

Maize, crushed or in the form of meal, is useful for all kinds of stock when fed in conjunction with concentrated cakes. At present prices it is dear, costing as much per food unit as linseed cake. Having a wide nutritive ratio it is valuable for giving mixed with concentrated cakes. Allowing for the cost of crushing, the meal is as cheap per food unit as the whole maize.

Maize Gluten Feed.—Nutritive ratio, 1:3.3. Price per food unit, 1s. 4½d.

This food, a by-product of maize, though having a different nutritive ratio, is very cheap per food unit, and (although there is still much to learn as to its feeding value in this country) it should prove a useful substitute for part of the concentrates,

since it is fairly rich in oil and protein. In the few cases in which it has been used extensively in England it has given very good results, being fed up to 5 lb. daily. It has been used in the United States with excellent results for dairy cattle and fattening stock, and is always used in conjunction with a light material such as wheat bran.

Maize Germ Meal.—Nutritive ratio, 1 : 8.4. Price per food unit, 1s. 8½d.

This, another by-product of maize, though differing in its nutritive ratio, is cheaper per unit, though containing more oil and protein, than maize meal. It should be worth a trial in many cases.

English Feeding Barley and Oats.—The use of these foods as feeding stuffs is strongly deprecated at the present time, as their price per unit is out of all proportion to their feeding value. (For substitutes for oats for farm horses, see Special Leaflet No. 19.)

Malt Culms.—Nutritive ratio, 1 : 3.6. Price per food unit, 1s. 7½d.

Malt culms form a brewery by-product, and are used extensively for stock in districts where they are readily obtained. They have a great reputation for feeding to fattening lambs, and at the present price per unit form a valuable and cheap food for general purposes.

Dried Brewers' Grains.—Nutritive ratio, 1 : 3.4. Price per food unit, 1s. 7½d.

Many experiments, at home and abroad, have established the value of this food for farm stock. It is a good feed for dairy cows, and is particularly useful for suckling ewes and growing lambs. It is quite wholesome and should be given a trial whenever it can be bought cheaply. At present prices it is a cheap food. (See also Special Leaflets Nos. 8 and 19.)

Wet Brewers' Grains.—Nutritive ratio, 1 : 3.4. Price per food unit, 1s. 1½d.

This food is the cheapest per food unit included in the table, and is largely used for feeding dairy cows. It is very palatable, and the low cost of the food is due to the fact that the difficulties of carriage restrict the consumption of the grains to certain localities, and to the fact that it varies very much in composition. Where available, wet grains should be used, but special care must be taken that they are delivered fresh, and that no more are given to the animals than can be consumed without causing scour. Over-feeding, especially after storage, leads to fermentation and consequent digestive disturbances. Where cleanliness and supervision of feeding

are exercised, this feeding stuff is very economical for the production of milk. It is largely used in Holland for fattening old cows for beef.

Rice Meal.—Nutritive ratio, 1 : 10.3. Price per food unit, 1s. 9½d.

Rice meal is very variable in quality, but where the analysis is good it is a cheap feeding stuff at present prices. It is particularly valuable for mixing with beans, with decorticated cotton cake, or with soy bean cake. A good mixture of English beans and rice meal can be made. It should not be used with common cotton cake. The best rice meal also forms the basis of many "calf meals," and mixed with bean meal and sharps forms a good food for fattening pigs. (Further information is given in Special Leaflet No. 16.)

"Middlings."—Nutritive ratio, 1 : 5.3. Price per food unit, 1s. 5½d.

Middlings is much used for dairy stock, being a wholesome and palatable feeding-stuff. It is also much used for growing pigs and suckling sows. It is, however, not much used for fattening, and it would seem that present prices suggest a much more extensive use. More especially is this the case if substituted for barley meal in the production of pork and bacon. Middlings often gives very good results when fed to young animals being rapidly fattened off at an early age as beef or mutton.

Sharps.—Nutritive ratio, 1 : 5.3. Price per food unit, 1s. 7½d.

Sharps are so much like middlings that the food unit price may well be left to decide which of these two should be fed.

Bran.—Nutritive ratio, 1 : 5.3. Price per food unit, 1s. 10d.

Except that bran is said to "scour" young pigs, and that it may be made very laxative by feeding as a warm "mash," the same remarks apply as to sharps. At present prices the feeding of broad bran seems to be extravagant. (More detailed information concerning these by-products is given in Special Leaflet No. 8.)

The prices given per ton in the table on p. 55 represent for the most part the price *ex mill*, and do not allow for customs of credit, carriage, etc. In some cases the prices given include sacks. Since, however, these affect to a similar extent all the foodstuffs given, the usefulness of the table is not affected, and the relative comparative values given still hold, although the price per food unit is low in every case.

The figures given in the table are the prices ruling *ex mill* at the beginning of April, but the computation of feeding stuffs whose market value has risen since then can be easily

obtained by dividing the price per ton by the number of food units given in the table against the foodstuff under consideration.

From the table given below, showing the relative cost per food unit of 30 feeding stuffs now on the market, it appears that the cost of 1 food unit in different feeding stuffs varies from 1s. 1½d. to 3s. 1d. This amount of variation is quite exceptional, being caused by the great demand for certain feeding stuffs for military purposes, irregularity of transit, and other conditions arising from the state of war. Under these circumstances it is obvious that considerable economies may be brought about by replacing the dearer feeding stuffs by the cheaper ones. The following table gives the cost per food unit of all the feeding stuffs in the list on p. 55. The figure given in each case is the average cost at all the markets from which quotations were received. In very few cases is there any considerable variation in cost at the different markets.

	s.	d.	
Brewers' grains (wet)	1	1½	per food unit.
Maize gluten feed	1	4½	" "
Soya bean cake	1	4½	" "
Coconut cake	1	5½	" "
Wheat middlings	1	5½	" "
Decorticated cotton cake	1	6	" "
Palm nut kernel cake	1	7	" "
Brewers' grains (dry)	1	7½	" "
Wheat sharps	1	7½	" "
Malt culms	1	7½	" "
Maize germ meal	1	8½	" "
Maize, Argentine	1	9	" "
Linseed cake, Indian	1	9	" "
Rice meal, Egyptian	1	9	" "
Wheat bran	1	9	" "
Rice meal, Burmese	1	9½	" "
Maize, American	1	10	" "
Linseed cake, English	1	10	" "
Wheat bran, broad	1	10½	" "
Cotton cake, Egyptian	1	11	" "
Beans, English	1	11	" "
Cotton cake, Bombay	2	0	" "
Maize meal	2	0½	" "
Beans, Chinese	2	1½	" "
Barley, English feeding	2	3	" "
Peas, English dun	2	4½	" "
Peas, English maple	2	9½	" "
Oats, Argentine	2	11½	" "
Peas, Calcutta white	3	0	" "
Oats, English	3	1	" "

It is satisfactory to note that feeding stuffs have decreased in price by about 1d. per food unit all round since the beginning of March.

The question of rations for different kinds of farm stock has been dealt with already in Leaflets No. 74 and No. 78. Special Leaflets Nos. 8, 16, and 19, also give suggestions for the modifications of rations to suit present conditions. Since they were issued, however, further changes in relative prices have occurred, to meet which the following notes have been prepared.

Farm Horses.—Since the issue of Special Leaflet No. 8 the price of oats has greatly increased, and very great economy can be attained by replacing oats by a mixture of feeding stuffs which have increased in price to a smaller extent than oats. For example, a mixture of 6 lb. of dried brewers' grains, 2 lb. of wheat sharps, 4 lb. of bran and 2 lb. of rice or maize meal, at present prices costs 11*d.* per stone, whilst a stone of oats costs 1*s.* 6*d.* The mixture is an excellent substitute for oats, and its use for horses getting a stone a day of corn results in a saving of about 7*d.* per head per day.

Fattening Cattle.—The present stall-feeding season is now approaching its end, and the few cattle still in the yards or boxes have probably reached the stage of finishing. In the earlier stages of fattening considerable economy might have been effected by substituting decorticated cotton cake, coconut cake, palm-nut cake or soya bean cake for linseed cake. For finishing, however, it will probably be wise to adopt a conservative policy, and adhere to a mixture of linseed cake and English bean meal, which may be relied on to produce a prime finish. Comparison of the prices per food unit shows that the saving which could be made by replacing such a tried and well-known finishing mixture by any of the less known cakes is not great enough to encourage graziers to take any risk.

Dairy Cows.—Where roots are short and grass is not ready brewers' grains at present prices will no doubt be much used for dairy cows if they can be bought fresh. In districts where they are available cow keepers are aware of the precautions necessary in using them. For dry food for dairy cows at present prices the following are amongst the cheapest suitable feeding stuffs:—Soya bean cake, decorticated cotton cake, coconut cake, palm-nut cake, dried grains, rice meal and bran. For use as an addition to usual quantities of home-grown fodders, the following rations may be suggested:

2 lb. Coconut cake.	{	or	{	2 lb. Palm-nut cake.
2 „ Gluten feed.				2 „ „ Gluten feed.
3 „ Dried grains.				3 „ „ Bran.
3 „ „ Bran.				3 „ „ Rice meal.

Sheep.—For sheep on roots and hay, or on grass, the following mixture used at the rate of from $\frac{1}{2}$ to 1 lb. per head per day is as good value for money as can be obtained at the present time: 1 stone of decorticated cotton cake, 2 stones of dried grains, and 2 stones of bran.

Pigs.—A series of rations for pigs of all ages was given in Special Leaflet No. 16. The foods there recommended are all amongst the cheapest per food unit at the present time. No improvement on the rations there recommended can be suggested.

OWING to the shortage of drugs, largely due to the loss of supplies from Germany and Austria-Hungary, an opportunity has arisen for the collection of drug plants in England by those who are in a position to use their knowledge of field botany in this way. The Board think, therefore, that members of Natural History Societies and Field Botany Clubs throughout the country may be prepared to take part in this work, and they suggest that such members might usefully co-operate in the collection and sale of drug plants during the present year.

Leaflet No. 288, on "The Cultivation and Collection of Medicinal Plants in England," contains information as to various drug plants, and copies may be obtained gratis on application to the Board.

The more important species are Foxglove, Henbane, Thorn Apple and Belladonna, but many other species are useful, as indicated in the leaflet. It is most desirable that some definite arrangement should be made at the outset as to the plants to be collected, their sale and dispatch.*

The buyer would, no doubt, be willing to supply information as to any special requirements in respect of drying, preserving and packing, as well as to the ordinary technique of such operations, since in connection with certain species careful drying or immediate delivery may be indispensable.

The Board would emphasise the necessity for the careful identification of species, since in some instances very similar species may readily be confused.

It is highly desirable that collection should be conducted with discretion, so that a given species may not be unduly depleted in any locality, but that an ample stock may be left to preserve continuity.

It is as well to warn those who may decide to take part in the collection of drug plants against doing anything which could be regarded by possible buyers as useless or tending to waste their time.

In view of the fact that seeds of the various species of medicinal plants are not readily obtainable, the desirability might also be considered of collecting during the coming season a supply of seeds both for the collector's own use, and for distribution to others.

* A list of probable buyers of English-grown medicinal herbs, with one or other of whom collectors of drug plants may be able to come to some arrangement, may be obtained on application to the Board.

At its first two meetings after the Christmas vacation, held in January and February, the Permanent Committee of the International Institute of Agriculture at Rome devoted most of its attention to a consideration of its financial position as indicated by the accounts for the past year and the budget for the coming year.

**The International
Institute of
Agriculture.
Financial Position.**

At first sight the accounts for the calendar year 1914 appeared very satisfactory, as they showed on the ordinary work of the Institute a surplus of receipts over expenditure of £11,500, owing mainly to the fact that, in accordance with the decision of the General Assembly of 1913, the contributions of the adhering States had been raised to the maximum and amounted for the past year to £34,000 as compared with £20,520 in the previous year. To these contributions of the States has to be added the munificent grant of £12,000 made annually to the Institute by H.M. the King of Italy. On the other hand, the expenditure of the year, which amounted to a little over £36,000, only slightly exceeded the expenditure of the previous year; and on the assumption that all sums due to the Institute had been realised by the end of the year and all sums payable by it had been paid, there would have been a net surplus of £12,000 to be carried to the Reserve Fund, raising that Fund to £31,000. But the accounts also showed that a number of the adhering States were at the end of the year in arrear with their contributions to the amount of £14,780, and that the cash actually in hand at the end of the year was only £17,000. In the case of some of the States in arrear the delay in the payment of the contribution was no doubt due to financial embarrassment increased by the outbreak of war. But in most cases it appeared to have been chiefly due to delay in connection with obtaining sanction to the entry of the increased contribution in the budgets of the different States, and there was every probability that the greater portion of these arrears would be paid by the adhering States within the succeeding months. As a matter of fact, by the middle of March £6,720 had already been recovered, and the amount of arrears for past years had then been reduced to £8,060.

In accordance with a suggestion made by the British delegate, the accounts for the past year were audited by the Accounts Sub-Committee, on whose report the President of the First Commission signed a certificate to the effect that they had been found to be correct.

Notwithstanding the fairly satisfactory condition of the finances the Permanent Committee thought it desirable to continue to exercise the greatest economy compatible with the carrying on of its ordinary work, more especially by refraining from filling up the vacancies caused on the staff by the departure of a number of employees to serve under their respective flags.

In the budget for the calendar year 1915 the receipts are estimated at £47,000, on the supposition that all the adhering States will pay their contributions for the year before the end of December next. On the expenditure side the Permanent Committee, after carefully considering every reduction of expenditure possible without impeding the regular working of the Institute, sanctioned a total ordinary expenditure of £35,500, leaving a balance of £11,500, so that after adjustment of certain items of income and expenditure which are dealt with under special heads, it is estimated that there will be a surplus on the year's working of £10,000 to be added to the Reserve Fund, making it £41,200 at the end of the year, or more than equivalent to a year's expenditure. It is considered desirable that the Institute should have a large reserve of this character, partly in order to provide for possible delays in the payment of their contributions by the adhering States, and partly to allow for a gradual increase in expenditure in future years, owing to the rise of salaries of members of the staff in proportion to the length of their service and to a gradual expansion of the work undertaken by the Institute. It will be observed that, notwithstanding the recent large increase in income, the budget for the coming year anticipates practically the same total expenditure as during the two past years. At the same time, it is hoped that the Institute will be able to carry on its usual work with regularity and punctuality, though the staff is temporarily depleted owing to the war.

Proposed Conference on Ocean Freights.—At the February meeting the delegate for the United States presented a joint resolution passed by both Houses of Congress, asking that the General Assembly of the Institute should take into consideration the question of ocean freights on agricultural produce. The desire so expressed was to the effect that the General Assembly should instruct the International Institute of Agriculture to invite the adhering Governments to take part in an International Conference, with the object of giving greater stability to the prices of agricultural produce in the

whole world. It was suggested that this Conference should be composed of delegates nominated by the Governments which adhere to the Institute, and should consider the desirability of drawing up a convention which would establish an International Commerce Commission for Merchant Shipping and Ocean Freights, with consultative and deliberative powers, including the power of proffering advice on its own initiative; the Conference to be held in Rome in the fortnight preceding the following session of the General Assembly of the Institute. This important proposal was warmly supported by a number of delegates, and the Permanent Committee agreed to place it on the programme of the proceedings of the next General Assembly, and to consider later on whether it will be necessary to draw up a special report on the subject for the information of the Assembly.

Relations with Tropical Countries and Colonies.—At a previous meeting the Permanent Committee had decided to invite all countries and colonies which have not yet directly adhered to the Institute to give their adherence now and to send it the official statistics and reports regarding their agricultural produce, which are required to make the bulletins published monthly by the Institute more complete. The British delegate pointed out that the present was not an opportune time for asking countries and colonies to incur new expenditure by giving their adherence to the Institute and making contributions to its funds, and on his suggestion it was agreed to suspend that part of the previous decision which invited the Colonies to contribute to the Institute, and to confine the proposed circular letter to a description of the services which the Institute rendered, and is in a position to render, to tropical countries, and a request that they will furnish the Institute with the information required for its bulletins, of which a number of copies would be sent to them in exchange free of charge.

THE Board of Agriculture and Fisheries have issued new Regulations for grants in aid of Agricultural Education and Research in England and Wales for 1915-16.* The pamphlet contains the conditions on which all grants made by the Board for these purposes are awarded. Hitherto the conditions attached to different types of grants have been set out in various memoranda and circulars, and it is hoped that local education

* Cd. 7841. Messrs. Wyman and Sons, Ltd., Fetter Lane, E.C. Price 2d.

authorities and agricultural institutions will find the collection of these conditions into one volume handy for reference purposes.

Grants to Institutions.—The Regulations set out the conditions on which grants are made to approved institutions for the purpose, mainly, of providing instruction in agriculture, forestry, and horticulture of an advanced type, and also the conditions on which certain supplementary grants are made to selected colleges for the purpose of extending and developing the provision of technical advice for agriculturists and the investigation of local problems. The conditions laid down do not represent any material departure from existing practice, except in so far as the Board propose in future to consult their Advisory Committee on Agricultural Science in connection with grants to a university or college, and to invite members or co-opted members of the Committee to visit the institution for the purpose of advising the Board as to the value of the educational and scientific work in progress, the suitability and sufficiency of the buildings and equipment, and the amount of grant which may properly be made. The section of the Regulations which deals with agricultural research contains no new matter; it is based upon the Board's Research Scheme, which was printed in the *Journal* for October, 1911.

Grants to Local Education Authorities.—The section of the Regulations which sets out the conditions on which grants are to be awarded in aid of agricultural education provided by local education authorities of administrative counties (other than London) is entirely new. The three main objects of the new Regulations are (1) to aid on an increased scale the expenditure of those local authorities whose work has hitherto been aided by relatively small grants; (2) to provide a uniform system of awarding grants; and (3) to link up the higher and lower forms of agricultural education.

The present Regulations are intended to equalise the charge upon rate-payers in different counties by taking into account the whole of the work and expenditure of local authorities on agricultural education on a uniform basis. The new consolidated grant is based on the principle that the cost of agricultural education should be defrayed on a "partnership" basis as between tax-payer and rate-payer. The Board have taken the view that one-third of the local expenditure should be regarded as the minimum quota which should be contributed by the rate-payers in each county in return for the

direct benefits derived from the education provided. The second share in the expenditure comes from the State in the form of the residue grant. This grant to the county is available for all forms of higher education. It has been necessary, therefore, to estimate the proportion of the total grant received by the county which should, having regard to the needs of the agricultural population, be devoted to agricultural education. The third share in the expenditure will be derived from the Board's grant, which is intended to defray the balance of the expenditure not met from the two sources already mentioned. Payment of the maximum grant will, however, be subject to certain conditions, the most important of which is that the whole of the education provided is carried out (1) in an efficient and satisfactory manner and (2) at a reasonable cost.

Co-ordination of the Agricultural Education provided by Colleges and Counties.—This is a new feature of the Regulations, and is intended to secure a more definite connection between the two grades of agricultural education than has hitherto been the case. The two forms of agricultural education are interdependent, and as the tax-payer is called upon to support both higher and lower types of instruction, the rate-payer who benefits by the partnership here described is expected to contribute at least some share of the cost of higher agricultural education. Most local education authorities already make maintenance grants to institutions providing higher agricultural education. In future, all authorities claiming the additional grants referred to above will be required to aid the maintenance of the centre for higher education of the province. In fixing the minimum qualifying contribution, the Board will take account of the character of the agricultural instruction provided and the net expenditure incurred by the agricultural education committees.

The object of this regulation is to secure that co-ordination of the various branches of agricultural education which is admitted to be desirable, but which has hitherto in some cases been lacking in actual practice. In the view of the Board the requirement of a definite contribution to the college will not only lead to a closer association of the county agricultural staff and the staff of the college, but will also provide the institutions in question with the means to extend their work in directions which are likely to prove of benefit to the locality.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Radio-Active Substances as Fertilisers (*U.S. Dept. of Agric., Bull. No. 149*).—The properties of radio-elements and the influence of radio-active rays on plants are discussed. The experiments in England by Hedworth Foulkes, on the Continent by Malpeaux, Berthault and Bretigniere (see this *Journal*, July, 1913, p. 324), and in Australia by Ewart, are reviewed and reference is made to the question of catalytic manures.

The conclusion is reached that "it seems incredible that radium or any of its products can have any economical application as a fertiliser in general farming; and still less credible that the so-called radio-active manure has any value, as far as its radio-activity is concerned, since the radium already present, on an average, in an acre-foot of soil, is about 100 times greater than is contained in the quantity of radio-active manure commonly recommended for application to an acre."

It is thought, however, that radio elements may prove of considerable value, justifying the expense involved, in botanical research, and possibly also in greenhouse work.

Evidence is given to show that the action of uranium on plants is due to its chemical properties rather than to its property of being radio-active, and that the conflicting results obtained with radio-active manure from different sources is to be explained largely by the presence of uranium and of such non-radio-active constituents as soluble salts and free acids.

The Production and Manurial Value of Citric Soluble Phosphoric Acid and Potash (*U.S. Dept. of Agric., Bull. No. 143*).—A method of obtaining both potash and phosphoric acid in citric soluble form has been devised. It consists of mixing together phosphate rock and felspar with the addition of small quantities of the oxides of iron and manganese to promote fluidity or lower the melting point of the slag, the mass being then heated to about 1400° C. for about 20 minutes. The resulting product is not only soluble in a 2 per cent. citric acid solution but is also fairly soluble in water saturated with carbon dioxide. Pot tests with typical soils showed that the mineral increased the growth of wheat plants, but the beneficial effect derived from such applications was not, on the whole, as marked as it was when more soluble forms of phosphate and potash were used. The indications are, however, that the slag product has a distinct manurial value.

Salt as a Substitute for Potash (*Univ. Coll. of N. Wales, Bangor, Dept. of Agric.*).—A pamphlet describing the advisory work of the College contains a note on potash manures in which reference is made to the use of salt in the absence of potash manures. It is explained that all North Wales soils, except the lightest sands, contain abundance of potash of which, however, only a small proportion is in a form available for the use of plants; but that the application of salt to the soil would increase the proportion of potash available by acting on the unavailable

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

supplies. The recommendation is therefore made that salt should be given to root crops—at the rate of 5 or 6 cwt. per acre for mangolds and 4 cwt. per acre for swedes and potatoes, the salt being broadcasted some weeks previous to sowing or planting the crop. Salt should not be mixed with superphosphate.

FIELD CROPS.

Varieties of Wheat (*E. Suffolk County Educ. Com., Rept. on Field Expts., Circ. 15, 1915*).—Tests with varieties of wheat were carried out at three centres in 1914, the soils being poor heavy land, good loam and heavy loam; the average yields were as follows:—Brooker's Double Standup 47 bush., Garton's Victor 46 bush., Swedish (Svalöf) Extra Squarehead II. 43½ bush., Squarehead's Master 39½ bush., and World's Wonder 39½ bush. The wheats took the following order as regards milling quality:—Squarehead's Master, Brooker's Double Standup, World's Wonder, Swedish Extra Squarehead II., and Victor.

Varieties of Wheat (*Northants C.C. First Ann. Rept. on Field Expts., 1914*).—Little Joss and Squarehead's Master gave rather better results than Essex Conqueror, Browick Grey Chaff, and Conc on a cold clay soil.

Varieties of Wheat (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1915*).—Both in 1913 and 1914 and both on a loam and gravelly soil Queen Wilhelmina gave larger yields than Red Fife in large scale experiments. In small scale experiments in 1914 at 17 centres the yields of grain per acre of four varieties were as follows:—White Standup, 25½ cwt.; White Queen, 24 cwt.; Red Chaff White, 23 cwt.; and Red Fife, 21½ cwt. These same varieties have given yields in the same order on the average of the previous six years.

Varieties of Winter Wheat (*East Anglian Inst. of Agric., Rept. on Field Expts., 1914*).—The experiments were carried out at four centres in 1914, the soils being of medium loam, heavy clay, chalky boulder clay and London clay respectively, the preceding crop at two centres being wheat. Sowing was carried out at the rate of 2 bushels per acre. The average yields per acre in bushels of 63 lb. were:—Little Joss 42.1, Victor 40.5, Squarehead's Master 39.4, Browick 36.3, Wilhelmina 36.2, Svalöf Extra Squarehead II. 36.2. Three varieties have been grown at the four centres for three years, the average results in bushels of 63 lb. per acre being:—Little Joss 41.7, Wilhelmina 39.7, Browick 37.6.

Varieties of Barley (*East Anglian Inst. of Agric., Rept. on Field Expts., 1914*).—The experiments were carried out in 1914 at four centres on strong loam, light loam on chalky subsoil, chalky boulder clay and light gravelly soils respectively, and the plots were sown at the rate of 3 bushels per acre. The average yields per acre of saleable grain in bushels of 56 lb. were:—Archer 45.1, Plumage-Archer 39.7, Plumage 38.8, Chevalier 34.6, Maltster 34.3. In the three years during which the trials have so far been continued the average results have been:—Archer 48.5, Plumage-Archer 46.5, Plumage 43.5, Chevalier 41.1, Maltster 39.8. Plumage-Archer, Maltster and Plumage (in the order given) were much superior in standing power to the remaining two varieties.

Varieties of Barley (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1915*).—Experiments in past years have shown that on heavy soils barleys of the broad-eared type succeed better than Archer, while Archer is relatively more prolific on light soil than broad-eared varieties. The results of trials in 1912, 1913 and 1914 with Beaven's "145" and Archer

indicate that there is no difference in yield between these varieties even on a light gravelly soil and under the very dry weather conditions experienced in 1914. Beaven's "145" proved considerably superior in yield in 1914 to Garton's Regenerated Standwell.

Small scale experiments showed the yield of Standwell to be inferior to Goldthorpe and the latter to be inferior to Archer.

Varieties of Oats (*East Anglian Inst. of Agric., Rept. on Field Expts., 1914*).—Sowing was carried out at the rate of 4 bush. per acre. The yields per acre (average of four centres) in bushels of 42 lb. were:—Leader 50.2, Golden Rain 48.6, Abundance 48.4, Beseler's Prolific 44.4, Victory 43.9, Potato Oat 35.9. Potato Oat produced most straw and Leader least.

Manuring of Barley (*Northants C.C. First Ann. Rept. on Field Expts., 1914*).—At two centres, both on gravelly loams, a dressing of 3 cwt. superphosphate, 1 cwt. sulphate of ammonia and $\frac{1}{2}$ cwt. sulphate of potash raised the yield of grain by 11½ bush. and 9½ bush. per acre respectively over that of the unmanured plots; when the potash was omitted from the dressing the increased yield, those of grain above on the unmanured plots, were 1½ bush. and 6½ bush. per acre respectively.

FEEDING AND DAIRYING.

Feeding for Winter Milk (*E. Sussex Educ. Com.; J. Noble Jack, F.R.S.E.*).—Of the 18 different rations tested the most satisfactory contained 1 lb. of albuminoids to 5 lb. starch equivalent, and the economy of production was affected adversely as this ratio was altered. The inferiority of other rations in comparison was due to an excess of starch; the free use of apparently cheap cakes, rich in oil and soluble carbohydrates, but low in albuminoids, accounting for the greater cost of the less productive foods; and the milk yield in every case was determined by the quantity of albuminoids present. For average herds in all stages of lactation 0.6 lb. digestible albuminoids and 3 lb. starch equivalent should, it is stated, be fed for every 10 lb. of milk given. The importance is emphasised of variety in compounding the ration and of analysis in purchasing foods.

Nutrition of Pigs (*Ohio Agric. Expt. Sta., Bull. 271*).—Maize, wheat middlings, linseed oil meal, soy beans, wheat bran and rice polish were shown to supply an insufficient amount of calcium to growing pigs, animals fed on these foods not maintaining normal growth of bone and therefore of size and strength. The importance of pasture, forage crops and dry roughage (especially of leguminous plants), as containing nutrients which grain foods lack, was demonstrated. Maize was found to be deficient in phosphorus and nitrogen as well as calcium. One part of salt to 256 parts of other food seemed to be more than sufficient for growing pigs.

Fish as Cattle Food (*Agric. Jour. of India, October, 1914*).—Dried and ground sardines were fed at the rate of $\frac{3}{4}$ lb. per head per day to six heifers for six months, six other heifers being used as controls. No ill effects followed from the addition of the fish to a mixed ration, and after a little time no trouble was experienced in getting the animals to eat it. So far as its fattening value was concerned fish did not compare favourably with ground nut. As a result it was not recommended for inland localities from a financial point of view though it was thought that a considerable saving might be effected by its use on the coast of India.

Wintering of Store Cattle (*U.S. Dept. of Agric., Bull. No. 110*).—The wintering of cattle by the use of concentrated foods in addition to pasture was found to be both economical and profitable for cattle which were to be fattened early in the summer; but the longer the summer grazing season the less economical and profitable was the previous winter feeding. Thus a difference, due to different winter feeding, of 109 lb. per steer at the beginning of the pasture season was reduced to 60 lb. by the time the animals were sold in July and August, and it was doubtful if there would have been any difference at all had all animals been pastured until October. (In this connection see also the Irish experiments summarised in this *Journal* for December, 1914, p. 842.)

HORTICULTURE.

Protection of Fruit from Frost (*Agric. Gazette of Canada, January, 1915*).—The heater used was the "Competition" heater, consisting of an ordinary pail of sheet iron with perforations round the top to allow of a draught of air and provided with a perforated rim fitting into the heater to assist the draught. Oil is used as fuel. One hundred heaters per acre have been found sufficient to raise the temperature of the surrounding air 8° F. on a very frosty night, and should raise the temperature by about 10° F. on a night having five or six degrees of frost. The method of distribution of the heaters depends upon the direction of the wind, the heaters being placed to windward of the area to be protected.

The initial expenditure per acre is given as £12 14s., viz., 100 heaters at 1s. 3½d. and a frost alarm thermometer at £6 5s. The cost of fuel and labour per acre for a night of 5 hours is given as £3 6s. 6d. The frost alarm thermometer is an arrangement for awakening the farmer when the temperature falls below a certain point.

In connection with the heater the use of a reflector for radiating the heat downwards was tried but without much success, as the effect was only felt immediately round the heater, and in the case of strawberries the plants round the heater were invariably burned.

WEEDS AND PLANT PESTS.

Fungicidal Action of Bordeaux Mixtures (*Jour. Agric. Sci., Vol. VI., Part 2; B. T. P. Barker, M.A., and C. T. Gunningham, F.I.C.*).—In order to throw more light upon the general action of copper fungicides, and, if possible, to obtain further evidence in support of conclusions previously reached,* experiments have been made to determine the action of copper compounds on plant cells other than those of fungi. The tests were made with broad bean, pea, and mustard seedlings, the root hairs of which provide types of cells comparable with the germ-tubes of fungus spores or the cells of actively growing hyphæ, and with apple leaves.

It was found that in some cases the root hairs were killed, deformed or discoloured as the result of the treatment, while in other instances they appeared to be uninjured. If the injurious action was due to the production of soluble copper by agencies other than the cell itself, the whole root-hair system should have been fairly equally affected instead of showing the extreme variations noted. It appeared, therefore, that living cells with readily permeable walls of the unchanged cellulose type

*See this *Journal* for December, 1911, p. 778.

or its equivalent are able to produce and absorb soluble copper from insoluble compounds.

The fate of the organism depends upon the relation between the amount of soluble copper produced and absorbed and the rate of growth of the organism. This is a significant point in connection with practical spraying, since it explains why there may be at times little check to the growth of a parasitic fungus after spraying, especially when the parasite has once gained a footing on the host plant.

Cells with walls of an impermeable character, such as those of apple leaves, possess no such power of solvent action upon insoluble copper compounds. In the case of apple leaves, only when there is injury to the cuticle sufficiently recent for no occlusion to have taken place, or when there is some radical alteration in its nature, is soluble copper produced.

Under changed conditions, cells with normally impermeable walls may become permeable and capable of action upon insoluble copper compounds. The difference in behaviour of apple foliage in summer and autumn would seem to be best explained in this way; and the change in the nature of the cell wall may be attributed to incipient death of the cells preparatory to leaf fall. This explanation accords with the fact that the hairs on the under surface of apple leaves (which are decadent cells) are affected by contact with the copper compound even in early summer when the epidermal cells (being full of life and vigour) remain unattacked.

It is evident, therefore, that the nature of the cell wall is the determinative factor in the direct action of the cell upon the Bordeaux compounds. It is stated that a comparison of the conclusions now reached with those derived from the previous experiments with cells of fungi shows that two distinct lines of work have led to identical results.

Potato Spraying with Bordeaux Paste and Bordeaux Mixture (*Woburn Exptl. Fruit Farm, 14th Report*).—The initial object of these experiments was to ascertain the proportion of Woburn Bordeaux paste equivalent in fungicidal action to ordinary Bordeaux mixture. The advantages claimed for the paste are simplicity of preparation of the spray fluid and the fact that a much smaller quantity of copper is required to produce a given result than in the case of Bordeaux mixture.

It was found that in a spray of moderate strength for ordinary potato disease 15 lb. or 16 lb. of paste to 100 gals. of water proved equivalent, as regards results, to Bordeaux mixture made with 8 lb. of copper sulphate. Trials were made with soda Bordeaux, but this preparation did not compare favourably with the paste or with ordinary Bordeaux mixture. Some experiments on soaking seed potatoes in copper sulphate solutions led only to a decreased yield. It appeared that with a fairly good crop, in years when disease is rife, one spraying with a fungicide of the strength indicated above may result in an increase in sound tubers of from 10 to 30 per cent.

The experiments seemed to indicate that while the percentage amount of disease present may actually be increased by spraying, the leaves are rendered more healthy and more free from the germs of disease generally, thus enabling the plant to bear a heavier crop. On the other hand, where the haulms are thus made more vigorous and succulent, they may afford a readier passage for the mycelium from such spores as have not been destroyed.

MACHINERY.

Milking Machines in Victoria (*Jour. Dept. of Agric., Victoria*, January, 1915).—Considerable use is made of milking machines in Victoria owing to the dearth of labour. To obtain the most satisfactory results the necessity of breaking in heifers to the machine and of the proper cleansing of the machines is insisted on. The writer does not think the yield is affected injuriously and considers the necessity of stripping by hand beneficial as massaging the udder and preventing atrophy. The cost of upkeep is placed at £1 per machine per annum.

From investigations carried out on a farm supplying infants with milk from healthy, tuberculin-tested cows the conclusions are drawn that (1) as regards bacterial contamination, milk obtained by machine is superior to hand-drawn milk even when the latter is obtained under the most approved conditions; and (2) that the machine does not interfere with the general health of the cow or of the udder provided that the apparatus is intelligently handled and that thorough attention is given to cleanliness and sterilisation.

NOTES ON CO-OPERATION AND SMALL HOLDINGS.

THE total quantity of land acquired under the Small Holdings Act up to 31st December, 1914, was 198,288 acres, 139,478 acres having been purchased for £4,601,692 and 58,810 acres leased for rents of £74,186 a year. Of

Progress of the Small Holdings Movement.* this land 178,911 acres had been actually let by county councils to 12,581 individual small holders and 506 acres sold to 50 small holders; and the councils of county boroughs have let 1,259 acres to 218 individual tenants. In addition 8,436 acres have been let to 63 co-operative small holdings associations, who have sub-let the land to 1,451 of their members, and 3,580 applicants have been provided with 47,500 acres by private landowners direct. The land which has been acquired by county councils, but which is not yet let in small holdings, amounts to 9,653 acres, which it is estimated will provide for 475 applicants, and the councils of county boroughs have about 310 acres not yet allotted which will probably provide for about another 50 applicants. It appears that the Act has resulted in the provision of small holdings for 18,486 applicants in seven years.

As regards the operations during 1914, these were considerably curtailed as a result of the war, the purchase of land being stopped and the rate of interest on loans granted by the Public Works Loan Commissioners for small holdings purposes being raised from 3½ to 4 per cent. In spite of the fact that the war prevented the purchase of any land during the last five months of 1914, the extent of the unsatisfied demand for small holdings at the end of the year was less than it had been at any time since the Act came into operation.

* Annual Report of Proceedings under the Small Holdings, &c., Acts for the year 1914. Part I.—Small Holdings. (Cd. 7851, price 3d.)

In continuation of the note on page 1113 of the Board's *Journal* for March, 1914, the following information is taken from the Report recently presented by the Minister for Agriculture on the working during 1913 of the co-operative credit societies in France, which are provided with a large proportion of their working capital by advances from State funds. At the end of 1913 there were 98 Central Banks (*Caisses regionales*), to which advances had been made by the State free of interest, the total amount at their disposal up to that date being £3,756,170.

The Central Banks had, at the end of 1913, advanced to local societies formed for the production and sale of agricultural produce, sums amounting to £527,500, on which the rate of interest charged was generally 2 per cent. The local societies in question have a membership of 48,000. Long-term loans amounting to £469,000 had also been granted to 3,098 peasants to enable them to obtain and work small holdings.

As regards the local credit societies formed for the purpose of making short-term loans to their members, the Report states that at the end of 1913 these societies numbered 4,533 with 236,860 members, an average of 52 members per society. They had a paid-up capital of £597,390, and during the year they made new loans to members amounting to £3,861,000, and recovered loans previously made to the amount of £3,509,000, the amount out on loan at the end of the year being £2,982,600. Their reserve funds at the end of the year amounted to £115,000.

NAMES AND ROUTES OF THE KING'S PREMIUM STALLIONS.

PARTICULARS of the Routes of the Stallions to which King's Premiums and Super-Premiums were awarded at the Show held at the Royal Agricultural Hall, Islington, London, N., on March 2nd and 3rd, 1915, together with the names and addresses of the owners of the Stallions, and of the members of the Stallion Committees which have been appointed to supervise the service arrangements, are given below. The Routes are subject to some alteration by arrangement between the owners and the Stallion Committees.

The District Classes for England and Wales are as follows:—

District Class.	Counties.	Number of King's Premiums.
I.	DURHAM NORTHUMBERLAND YORK, N. RIDING	Four King's Premiums.
II.	CUMBERLAND LANCASTER WESTMORLAND	Three King's Premiums.
III.	YORK, E. RIDING YORK, W. RIDING	Six King's Premiums.

District Class.	Counties.	Number of King's Premiums.
IV.	LINCOLN, Parts of HOLLAND " " KESTIVEN " " LINDSEY NOTTS "	Two King's Premiums.
V.	DERBY STAFFORD	Two King's Premiums.
VI.	CHESTER HEREFORD SALOP	Three King's Premiums.
VII.	ANGLESEY BRECKNOCK CARDIGAN CARMARTHEN CARNARVON DENBIGH FLINT GLAMORGAN MERIONETH MONMOUTH MONTGOMERY PEMBROKE RADNOR	Five King's Premiums.
VIII.	GLOUCESTER OXFORD WARWICK WORCESTER	Four King's Premiums.
IX.	BEDFORD HUNTS LEICESTER NORTHAMPTON RUTLAND SOKE OF PETERBORO'	Three King's Premiums.
X.	CAMES ISLE OF ELY NORFOLK SUFFOLK	Two King's Premiums.
XI.	BUCKS ESSEX HERTS MIDDLESEX	Three King's Premiums.
XII.	KENT SURREY SUSSEX, EAST " WEST	Three King's Premiums.
XIII.	BERKS HANTS ISLE OF WIGHT	Three King's Premiums.
XIV.	DORSET SOMERSET WILTS	Four King's Premiums.
XV.	CORNWALL DEVON	Three King's Premiums.

District Class.	Stallion and Owner.	Counties in which travelling.	Route.	Stallion Committee.
I.	Sandow. The Compton Stud, Sandley, Gillingham, Dorset.	York (North Riding).	Headquarters :—Langton Hall Travels Thirsk, Pickhill, Bedale, Northallerton, Great Smeaton, Croft, and Richmond.	Mr. J. F. Baker-Baker, East Hall, Middleton Tyas, Yorkshire. Mr. T. Clark, Winton House, Northallerton. Mr. E. H. Courage, The Hall, Kirkby Fleetham, Bedale.
	Fitz Richard. Dr. A. O. Haslewood, Fairfield Stud, Buxton.	Northumberland.	Headquarters :—Alnwick. Travels Howick, Duxford, Chat- ton, Doddington, Lewick, Ford, Cornhill, Wooler, and Anham.	Mr. B. Clayhills, Estates Office, Callalee, Whittingham, Northumberland. Mr. A. Rawcus, Louth Charton Farm, Alnwick. Mr. I. Patten, The Park Farm, Alnwick. Mr. G. G. Rea, Middleton, Wooler, Nor- thumberland.
	Maitre Corbeau. Capt. T. L. Wickham-Boynton, and Mr. H. A. Cholmondeley, Burton Agnes Hall, Driffield.	York (North Riding).	Headquarters :—Pickering Travels Malton, Gilling, Helms- sley, Kirby-Moorside, and Snainton.	Mr. A. Pearson, Helmsley. Mr. J. Peters, Duncombe Park Estate Office, Helmsley.
	Jovial. The Lord Middleton, Birdsall, Malton.	York (North Riding).	Headquarters :—Birdsall Travels Malton, Pickering, Nor- manby, Salton, Slingsby, Hovingham, Terrington, and Sheriff Hutton.	Capt. Clive Behrens, Swinton Grange, Malton. The Hon. T. Willoughby, Hildenley Home Farm, Malton. Mr. E. Parsons, Birdsall, Malton.

<p>Elector. Mr. A. Mc Mahon, Corbally House, Ballylinan, Athy, Ireland.</p>	<p>Cumberland .. Headquarters :- Carlisle Travels Cockermouth, Aspatrick, Penrith, Longtown, and Brampton.</p>	<p>Mr. G. M. Bell, Land Agent, 1, Lonsdale Street, Carlisle. Mr. R. Edle, James, Manor House, Outherside, Carlisle. Mr. W. R. Mounsey, 20, King Street, Penrith.</p>
<p>Tates. Mr. R. Rimmer, M.R.C.V.S., 52, Stramongate, Kendal.</p>	<p>Westmorland. Headquarters :- Kendal Travels Appleby, Ashburn, Shap, Windermere, Kirkby Lonsdale, and Milnthorpe.</p>	<p>Mr. G. G. Robinson, Underley Farm, Kirkby Lonsdale. Mr. J. Wilson, Victoria Road, Penrith.</p>
<p>Soft Answer. Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.</p>	<p>Lancashire .. Headquarters :- Carlisle Travels Lindale, Fleetburgh, Barrow-in-Furness, Kossie, Dalton, Ulverston, Carnforth, and Lancaster.</p>	<p>Mr. E. Bohane, Derby House, Preston. Mr. G. Dickinson, Cark Mills, Cark-in- Cartmel, Lancashire. Dr. E. S. Jackson, Robin Hill, Carnforth.</p>
<p>* Birk Gill. Capt. T. L. Wickham-Boynnton, and Mr. H. A. Cholmondeley, Burton Agnes Hall, Driffield.</p>	<p>York (East Riding). Headquarters :- Burton Agnes Travels Beecroft, Brandesburton, Beverley, Epton, and Driffield.</p>	<p>Mr. F. Reynard, Sunderlandwick, Driffield. Capt. J. Ridley, M.R.C.V.S., Beverley. Mr. G. Whiting, Estate Office, Burton Agnes, Driffield.</p>
<p>* Bachelor's Lodge. Capt. T. L. Wickham-Boynnton, and Mr. H. A. Cholmondeley, Burton Agnes Hall, Driffield.</p>	<p>York (East Riding). Headquarters :- Burton Agnes Travels Swine, Humbleton, Nutt Hill, and Hedon.</p>	<p>Mr. F. Reynard, Sunderlandwick, Driffield. Mr. T. Robinson, Nutt Hill, nr. Hedon, Hull. Mr. G. Whiting, Estate Office, Burton Agnes, Driffield.</p>

* Indicates the award of a Super-Premium.

† Indicates the award of the King's Champion Challenge Cup.

District Class.	Stallion and Owner.	Counties in which travelling.	Route.	Stallion Committee.
III. <i>cont.</i>	Berrill. Capt. T. L. Wickham-Boynston, and Mr. H. A. Cholmondeley, Burton Agnes Hall, Driffield.	York (East Riding).	Headquarters :—Burton Agnes Travels Bridlington, Filey, Hun- manby, Weaverthorpe, Sled- mere, and Killham.	Mr. R. Dixon, Dunnington Manor, Seaton, Hull. Mr. H. Holtby, Kilham, Driffield. Mr. G. Whiting, Estate Office, Burton Agnes, Driffield.
	Forcott. Mr. J. Lett, Rillington, York.	York (East Riding).	Headquarters :—Rillington .. Travels Heslerton, Sherburn, Ganton, Foxholes, and Seamer	Mr. F. Keynard, Sunderlandwick, Driffield. Hon. T. Willoughby, Hildesley Home Farm, Malton. Mr. H. Wrigley, Ganton, Scarborough.
	Merry Fox. Capt. A. E. Clerk, c/o The Manager, Burton Agnes Stud, Driffield.	York (West Riding).	Headquarters :—Chestnut Grove, Boston Spa. Travels Wetherby, Harrogate, Knaresborough, Ripon, Tad- Boroughbridge, and Tad- caster.	Mr. B. Day, The Rookery, Chapel Allerton, Leeds. Mr. B. North, 31, Market Place, Ripon. Mr. T. Robinson, The Laurels, Wetherby.
	Crathorne. The Lord Middleton, Birdsall, Malton.	York (East Riding).	Headquarters :—Birdsall .. Travels Bossall, Stamford Bridge, Eserick, Market Weighton, and Pocklington.	Mr. C. N. Thompson, Red House, Eserick, York. The Hon. T. Willoughby, Hildesley Home Farm, Malton. Mr. E. Parsons, Birdsall, Malton.
IV.	Wisemac. Messrs. C. J. C. Hull and H. Drage, Glentworth Hall, Lincoln.	Lincoln (Lindsey)	Headquarters :—Glentworth. Travels Torksey, Lincoln, Brigg, and Caistor.	Mr. F. A. Holmes, M.R.C.V.S., Henswell, Lincoln. Mr. Clifford Nicholson, Horkstow Manor, Barton-on-Humber, Hull. Mr. H. C. Tong, Office of the County Council, Mint Street, Lincoln.

IV. cont.	<p>Indian Runner. Lt.-Col. R. H. Birkin, D.S.O., Edale House, The Park, Nottingham.</p>	Nottingham ..	<p>Headquarters :—Nottingham .. Travels East Leake, Clifton, Croxwell Butler, Bingham, Flaxborough, Newark, Ed- borough, Tuxford, Ollerton, and Southwell.</p>	<p>Mr. J. Ellerby, Flaxborough, Newark. Mr. F. Hardy, Staunton Hall, Nottingham. Mr. O. Quibell, Shalem Lodge, Newark. Mr. F. O. Thurman, Welldale, East Leake, Loughborough. Mr. H. W. T. Patterson, The Repository, Parliament Street, Nottingham.</p>
V.	<p>St. Fagans. Messrs. J. P. Rees and W. V. Howell Thomas, 22, Llaninas Street, Carmarthen.</p> <p>King of the Wavelets. Dr. A. O. Haslewood, (Lessee), Fairfield Stud, Buxton.</p>	Stafford ..	<p>Headquarters :—Madeley .. Travels Trentham, Newcastle, Longton, Stone, Lichfield, Penkridge, Stafford, Eccles- hall, and Whitmore.</p>	<p>Mr. R. Carlless, M.R.C.V.S., Stafford. Mr. J. Keen, Orgrave Gorse, Lichfield. Mr. R. S. Wilkinson, Swinchurch, Newcastle, Staffs. Mr. H. J. C. Winterton, Lichfield. Mr. E. Woodcock, M.R.C.V.S., Eccleshall, Stafford.</p>
VI.	<p>* Neyland. Major H. Heywood-Lansdale, Shavington Grange, Market Drayton.</p>	Salop ..	<p>Headquarters :—Market Drayton Travels High Ercall, Shrews- bury, Oswestry, Ellesmere and Whitchurch.</p>	<p>Mr. R. Hughes, F.R.C.V.S., Oswestry. Mr. A. Mackenzie, F.R.C.V.S., Market Drayton. Mr. T. Whitfield, 12, Talbot Chambers, Shrewsbury. Mr. H. W. Fell, Shavington Grange, Market Drayton.</p>

* Indicates the award of a Super-Premium.

District Class.	Stallion and Owner.	Counties in which travelling.	Route.	Stallion Committee.
VI. <i>cont.</i>	Bacton Lad. Mr. F. W. Barling, M.R.C.V.S., Bartestree Court, Hereford.	Hereford	Headquarters:—Hereford Travels Ledbury, Ross, Leominster, and Bromyard.	Mr. J. Bird, Livers Ocle, Hereford. Mr. E. H. Landon, Bullingham, Hereford. Capt. T. R. Synmonds, Nynde Park, Hereford.
	Rays Cross. Mr. L. Cookson, Foxleigh, Wem, Shrewsbury.	Chester	Headquarters:—Tarporey Travels Banbury, Nantwich, Crewe, Sandbach, Middlewich, Minshall Vernon, Wetenhall, Northwich, Chester, and Tarvin.	The Rev. Canon J. R. Armitstead, The Vicarage, Sandbach. Mr. E. C. Griffiths, Broken Cross, Northwich. Sir Gilbert Greenall, Bart., C.V.O., Walton Hall, Warrington. Mr. J. W. Macfie, Rowton Hall, Chester. Mr. G. Norris Midwood, The Grange, North Kode, Congleton. Mr. C. E. Torton, Haughton Hall Farm, Tarporey. Mr. D. E. Pools, Marbury Hall, Whitechurch.
VII.	* Bachelor's Charm. Lieut.-Colonel David Davies, M.P., M.F.H., "Bronetion," Llandinam, Montgomery.	Glamorgan	Headquarters:—Cowbridge Travels Wenvoe, St. Fagan's, Llantwit-Major, Caerphilly and Abercynon.	Col. W. Forrest, D.S.O., Plymouth Estate Office, St. Fagan's, Cardiff. Mr. Iltyd Williams, Castleton, St. Athan, Cardiff. Mr. E. T. Lloyd, West House, Llantwit-Major, Cardiff.
	Syonby. Messrs. J. F. Rees and W. V. Howell Thomas, 22, Llanmas Street, Carmarthen.	Carmarthen	Headquarters:—Carmarthen Travels Nantcareddig, Llanarthney, Kidwelly, St. Clears, Whitland, Llanboidy, and Mydram.	Mr. R. H. Harries, The Croft, St. Clears, Carmarthenshire. Mr. E. Jones, Manoravon, Llandilo, Carmarthenshire. Mr. D. H. Thomas, Starling Park, Carmarthen.

District Class.	Stallion and Owner.	Counties in which travelling.	Route.	Stallion Committee.
VIII. <i>cont.</i>	* Newmarket. Lord Willoughby de Broke, Compton Verney, Warwick.	Warwick	Headquarters :—Kington Travels Wellesbourne, Hampton Lucy, Stratford-on-Avon, Ox- hill, Penny Compton, and Radway.	Lord Willoughby de Broke, Compton Verney, Warwick. Mr. C. Kendal, Mount Pleasant, Walton, Warwick. Mr. J. Lea, Charlecote, Warwick. Mr. J. Wilkes, Freington, Shipston-on- Stour.
	* Puro Caster. Lord Willoughby de Broke, Compton Verney, Warwick.	Worcester	Headquarters :—Compton Verney. Travels Worcester, Droitwich, Kidderminster, Ironsgrave, and Redditch.	Major J. Baldwin, Groveley Park, Coston- Hackett Birmingham. Mr. R. Cottrell, Sundal Lodge, Droitwich, Mr. A. Jones, Ombersley, Droitwich.
IX.	* Chanteur. Mr. J. Drage, Northampton.	Northampton	Headquarters :—Chapel Brampton. Travels Northampton, Welling- borough, Kettering, and Mar- ket Harborough.	Mr. J. Brown, Earls Barton House, North- ampton. Mr. E. Messinger, Chapel Brampton, Northampton. Mr. H. R. Roe, Cranoe, Market Harborough.
	Lord Harry. The Earl of Lonsdale, Barley Thorpe, Oakham.	Rutland and Leicester.	Headquarters :—Oakham. Travels North Luffenham, Up- pingham, Melton Mowbray, and Loughborough.	Mr. H. S. Black, Frisby-on-Wreake, Leicester. Mr. J. Northen, Thorpe-by-Water, Upping- ham. Mr. G. Underwood, Barley Thorpe, Oakham. Mr. D. Ward, Bescaby House, Melton Mowbray.

IX. <i>cont.</i>	Chevalier. Mr. D. Faser, Tickford Park, Newport Pagnell.	Northampton...	Headquarters:—Colchester, Fiddicks, Althorp, and Travels:—Harmston, Blyth, Howden, Brackley, Daven- try, and West Haddon.	Mr. W. Mulford, Hadley House, Dunsbury, Northants. Mr. W. George, Gayton, Blisworth, Northants. Mr. J. G. Lawrence, Newnham, Daventry. Capt. E. D. Alexander, Chapel Brampton, Northampton.
	Faithful Don. Mr. Washington Charters, Horringer Manor, Bury St. Edmunds.	Suffolk	Headquarters:—Newton Travels:—Bury St. Edmunds, Haverhill, and Stowmarket.	Mr. J. P. Brown, Rushbrooke, Bury St. Edmunds. Mr. S. Jaggard, The Quocch, Takenham, Bury St. Edmunds. Mr. H. Westrop, Long Melford.
X.	The Tallor. Mr. R. S. Howes (Lessee). The "Kensels," East Dereham, Norfolk.	Suffolk...	Travels:—Ipswich, Woodbridge, Needham Market, Hadleigh, Bibdeston, and Saxmundham.	Mr. J. G. Howells, St. Edmund's Road, Ipswich. Mr. J. Koeble, Brantham Hall, Manning- tree, Essex. Mr. F. Stearn, Old Newton, Stowmarket.
	Captain Jack. Mr. A. S. Dowling, Gilston Park, Harlow.	Essex	Headquarters:—Gilston Park. Travels:—Bishop's Stortford, Dun- mow, Braintree, Witham, Chelmsford, Ongar, and Harlow.	Mr. T. Christy, Roxwell, Chelmsford. Mr. J. Hughes, Gilston Park, Harlow. Mr. A. Waters, Coopersale Lodge, Epping. Mr. J. Bishop Young, F.R.C.V.S., Braun- tree.
XI.	Uplian. Mr. D. Fraser, Tickford Park, Newport Pagnell.	Buckingham	Headquarters:—Newport Pagnell. Travels:—Cosgrove, Hanslope, Stony Stratford, Buckingham, and Penny Stratford.	Mr. F. W. Coates, Ladbury, Newport Pagnell. Mr. M. Grimes, Tickford Park Stud, New- port Pagnell. Mr. C. D. Pennant, Lillingstone Dayrell, Buckingham.

* Indicates the award of a Super-Premium.

District Class.	Stallion and Owner.	Counties in which travelling.	Route.	Stallion Committee.
XI. cont.	King Frederick. Mr. H. J. King, Poles, Ware.	Hertford	Headquarters :—Poles, Ware. Travels :—Stevenage, Hitchin, Codicote, Hatfield, Northaw, Broxbourne, Hoddeston, and Hertford.	Lieut. Col. B. J. Gripper, The Drill Hall, Hertford. Capt. W. P. Jelfcock, West Common, Harpden, Herts. Mr. J. C. McCowan, Hatfield.
	Stortford. Capt. H. Radcliff Phillips, Mapleton Stud, Eden Bridge.	Kent	Headquarters :—Eden Bridge. Travels :—Tonbridge, Paddock Wood, Maidstone, Kemsing, and Sevenoaks.	Mr. J. P. Hervey Faulkners, Hadlow, Kent. Mr. T. P. Hiron, Linton Park, Maidstone. Mr. G. B. Winch, Boughton Place, Maid- stone. Mr. W. G. Lambard, Bradbourne Hall, Sevenoaks.
	Rockaway. Mr. C. Kelway-Bamber, "Priestlands Stud," Martyns, Crawley.	Surrey and West Sussex.	Headquarters :—Crawley. Travels :—East Grinstead, Hor- sham, Guildford, Leather- head, Epsom, and Reigate.	Mr. J. H. Driver, Melrose, Horsham, Woking. Mr. G. C. G. Leveson-Gower, Hisey Place, Limpshire, Surrey. Capt. A. Smith, Roiley, Horslam. Mr. H. C. J. Steere, Jayes Park, Ockley, Dorking.
XII.	Terra-cotta. Mr. C. Kelway-Bamber, "Priestlands Stud," Martyns, Crawley.	East Sussex	Headquarters :—Jewes Travels :—Hassocks, Hayward's Heath, East Grinstead, Uck- field, Heathfield, Battle, and Polgarate.	Mr. Watkin James, Fir Grove, Burgess Hill, Sussex. Mr. J. E. Muggoridge, New Place, Fram- field, Chichester. Mr. H. J. Simmons, Wychmour, Battle, Sussex. Mr. T. Kirby Stapley, M.E.H., The Kennels, Cadsfield, Battle, Sussex.

<p>Gog. The Compton Stud, Sandley, Gillingham, Dorset.</p> <p>General Stossel. Mr. S. Mansford, Stud Farm, Morton, Warwick.</p>	<p>Perks</p> <p>Headquarters:—Barkham Travels Wyford, Maidenhead, Windsor, Ascot, Bracknell, Wokingham, Strathfieldsaye, Bartley Row, Chilham, and Valeley.</p> <p>Hants</p> <p>Headquarters:—Bishop's Waltham. Travels Titchborne, Alton, Basingstoke, Whitechurch, and Hursley Park.</p>	<p>Perks</p> <p>Headquarters:—Barkham Travels Wyford, Maidenhead, Windsor, Ascot, Bracknell, Wokingham, Strathfieldsaye, Bartley Row, Chilham, and Valeley.</p> <p>Hants</p> <p>Headquarters:—Bishop's Waltham. Travels Titchborne, Alton, Basingstoke, Whitechurch, and Hursley Park.</p>	<p>Perks</p> <p>Headquarters:—Barkham Travels Wyford, Maidenhead, Windsor, Ascot, Bracknell, Wokingham, Strathfieldsaye, Bartley Row, Chilham, and Valeley.</p> <p>Hants</p> <p>Headquarters:—Bishop's Waltham. Travels Titchborne, Alton, Basingstoke, Whitechurch, and Hursley Park.</p>	<p>Perks</p> <p>Headquarters:—Barkham Travels Wyford, Maidenhead, Windsor, Ascot, Bracknell, Wokingham, Strathfieldsaye, Bartley Row, Chilham, and Valeley.</p> <p>Hants</p> <p>Headquarters:—Bishop's Waltham. Travels Titchborne, Alton, Basingstoke, Whitechurch, and Hursley Park.</p>
<p>Gilgandra. The Compton Stud, Sandley, Gillingham, Dorset.</p> <p>Bagotstown. The Compton Stud, Sandley, Gillingham, Dorset.</p>	<p>Somerset</p> <p>Headquarters:—Sandley Travels Frome and Shepton Mallet.</p> <p>Wiltshire</p> <p>Headquarters:—Swindon Travels Wootton Bassett, Mal- mesbury, Cricklade, and High- worth.</p>	<p>Somerset</p> <p>Headquarters:—Sandley Travels Frome and Shepton Mallet.</p> <p>Wiltshire</p> <p>Headquarters:—Swindon Travels Wootton Bassett, Mal- mesbury, Cricklade, and High- worth.</p>	<p>Somerset</p> <p>Headquarters:—Sandley Travels Frome and Shepton Mallet.</p> <p>Wiltshire</p> <p>Headquarters:—Swindon Travels Wootton Bassett, Mal- mesbury, Cricklade, and High- worth.</p>	<p>Somerset</p> <p>Headquarters:—Sandley Travels Frome and Shepton Mallet.</p> <p>Wiltshire</p> <p>Headquarters:—Swindon Travels Wootton Bassett, Mal- mesbury, Cricklade, and High- worth.</p>

* Indicates the award of a Super-Premium.

District Class.	Stallion and Owner.	Counties in which travelling.	Route.	Stallion Committee.
XIV. <i>cont.</i>	* Renown. The Compton Stud, Sandley, Gillingham, Dorset.	Wilts	Headquarters:—Chippenham. Travels Melksham, Westbury, Devizes, and Calne.	Mr. F. Doble, Berwick Bassett, Swindon. Mr. W. Preston, M.F.H., Seind, Melksham. Mr. V. T. Taylor, Stembrook House, Chippenham.
	Thistledown. The Compton Stud, Sandley, Gillingham, Dorset.	Dorset	Headquarters:—Dorchester. Travels Badport, Beaminster, Maiden Newton, Cerne Abbas, Puddletown, and Bere Regis.	Col. Brough, 56, High West Street, Dorchester. Mr. R. G. Caye, Almer, Blandford. Mr. F. Pope, Great Toller, Dorchester.
XV.	Colden Grebe. Messrs. W. & H. Whitley, Trinley Farm, Painington.	Cornwall	Travels Totnes, Liskeard, St. Austell, Truro, St. Columb, Wadebridge, and Bodmin.	Mr. C. Burdigh, Sportsman's Arms, Menheniot Station, Liskeard. Mr. Conlter Hancock, Tz, Princes Street, Truro. Mr. H. G. P. Hoblyn, Colquite, Washaway, Cornwall. Mr. Brooking Trant, Trehawle, Liskeard. Mr. T. Yeo, St. Leonards, Bodmin.
	Marzio. Mr. M. J. Taylor, Ermington, Ivybridge.	Devon	Headquarters:—Ermington. Travels Plympton, Ivybridge, Brent, Totnes, Newton Abbot, Dawlish, and Exeter.	Mr. P. G. Bond, M.R.C.V.S., 105, Union Street, Plymouth. Mr. A. Hingston, Bridgetown, Totnes. Mr. R. Johnson Marr, Kingsbridge.
	Otorton. Mr. Jerry Rolan, Loughcarrig, Ballinacurra, Midleton, Co. Cork.	Devon	Travels Honiton, Exeter, Crediton, Tiverton, and Cullompton.	Mr. Ian H. Amory, Knightslayes Court, Tiverton. Mr. R. J. Brown, Boro' House, Axmouth, Axminster. Mr. W. B. Nelder, F.R.C.V.S., 33, Paul Street, Exeter.
		Ireland		

* Indicates the name of a Sire's Pedigree.

OFFICIAL NOTICES AND CIRCULARS.

THE purpose of the Board's Special Leaflets was explained in the note in the *Journal* for September, 1914, p. 566, and lists of those issued have been given from time to time. The following further Special Leaflets have been prepared :—

- | | |
|---------------------|--|
| Special Leaflet No. | 24.—Seed Testing. |
| " " | 25.—Technical Advice for Farmers. |
| " " | 26.—Suggestions to Allotment Holders for General Cropping during the Spring and Summer Months. |
| " " | 28.—Suggestions for the Cultivation of Catch Crops and Home Grown Feeding Stuffs. |
| " " | 29.—Flax Growing for Fibre. |

IN view of enquiries received as to methods of dealing with the depredations of rats on farm premises, the Board of Agriculture and Fisheries are reissuing a Leaflet on the subject containing suggestions for concerted action for the extermination of these pests. Copies of the Leaflet (No. 24.—The Destruction of Rats) may be obtained free on application to the Secretary of the Board, 4, Whitehall Place, London, S.W.

THE Report of the Board for the year 1914 of proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, &c., has been recently issued [Cd. 7852, price 5½d.]. It contains *inter alia* an account of the work accomplished during 1914 with regard to foot-and-mouth disease, tuberculosis, swine-fever, sheep scab, anthrax, glanders, and parasitic mange, and gives details of the modifications which were made by the Board in their usual procedure in various instances as a consequence of the outbreak of war. A number of useful statistical tables are included at the end of the Report.

MISCELLANEOUS NOTES.

RETURNS obtained by the Board of Trade during February from over 30,000 farmers throughout England and Wales show that the number of male persons in regular employment at the end of January, 1915, was 12·4 per cent. less than in January, 1914. As 15·6 per cent. of the persons employed a year ago have joined the naval or military forces, it is evident that farmers have been able to fill the places of one in five of those who have joined. These men have been replaced from the ranks of casuals or

from among those who get fairly continuous work in the summer, but are unemployed, or do other than agricultural work, in the winter:

The table below gives for each Labour Exchange district the percentage of those employed a year ago who had joined the forces by the end of January :—

Percentage of Agricultural Employees who have joined the forces in various Labour Exchange Districts in England and Wales. (Number employed in January, 1914 = 100.)

	Per cent.		Per cent.
South Eastern ..	15·7	Yorkshire ..	17·3
South Western ..	18·0	Northern ..	9·6
West Midlands ..	14·9	North Western ..	14·2
East Midlands ..	12·7	Wales ..	14·9
Average ..		15·6	

The fact that the above figures include a certain number who are employed as civilians by the Government for other than military purposes, partly explains the very high figure for the South Western Division, since considerable numbers have been attracted in Wiltshire to the various military camps on Salisbury Plain. The elimination of this element would not, however, reduce the gross figure probably by more than 1 per cent.

In the West Midlands, the great prosperity of industry, and the demand for labour in the metal trades, are responsible for keeping the enlistment percentage low in industrial employments, while the same consideration is responsible for the even lower figure in Yorkshire; but agriculturists in both these districts have enlisted in considerable numbers. In the northern counties, the low percentage of recruiting in agriculture is explainable by the fact that in some of these counties May hirings are the rule rather than winter hirings, and several correspondents state that farmers are expecting a very considerable increase of enlistment when the men have served out their year.

As regards casual labour, the returns show that the number of casuals at work, though slightly below the figures for a year ago, are not abnormal for the time of year. In view, however, of the shortage of regular hands, farmers complain that the supply is less than the demand, and in particular it has been difficult to get a sufficient number of men for threshing. Casual employment, however, in the winter months is always small; the numbers amounting to about one-quarter of the number required in the summer months.

At the time of the enquiry (end of January) the lack of labour in agriculture could hardly be called acute, since the work to be done in winter is less than at any other season, and in a normal year even the regular hands are not always fully employed. Generally speaking, therefore, farmers were managing to carry on with their reduced staff, except that where labour of special skill was required it was almost impossible to fill the places of men who had joined the forces. This may in cases seriously disturb the whole farm. Thus, the most urgent need at the moment was for milkers, horsemen (who have been recruited in especially large numbers for the new armies), and men competent to work threshing machines. The immediate scarcity of labourers was being most acutely felt in Surrey, Sussex, and Wiltshire, in all of which the demand by the military for camp building, etc., has drawn men from agriculture; in Staffordshire and Warwickshire, where men have been attracted townwards by the very great prosperity of the Birmingham district; in

Westmorland and Yorkshire, where there has been rather heavy enlistment from the agricultural classes, and where labour was already getting scarce before the war; and in South Wales, where there is a general complaint of agricultural labourers being attracted to the mines.

The returns give some indication of the summer needs of agriculture. The number of men in continuous employment appears to be normally about 4 per cent. larger in the summer than in the winter. To bring the labour supply, therefore, up to normal dimensions would require not merely the making good of the existing contraction of 12·4 per cent., but also the addition of a further 4 per cent. of regular hands. There would also be required something like a four-fold increase in the present number of casual labourers. In other words, it may be estimated that unless the farms are to work shorthanded, or means can be found to economise labour, some 80,000 additional permanent male labourers and 90,000 casuals will be required in the summer (June). A certain proportion of the latter will, no doubt, be available as usual, but in view of the present state of the labour market, farmers are doubtful of their ability to find all this additional male labour. Steps are therefore being taken to meet the difficulties in various ways.

In many cases unessential work, such as clipping hedges, etc., is being left undone.

In Gloucestershire and Herefordshire, farmers are laying down land to grass, while in several counties it is reported that milch cows have been sold owing to the shortage of qualified milkers. The high price of feeding-stuffs is, however, a co-ordinate consideration in the matter. In Essex, it is stated, corn is being grown instead of roots, as the latter require much labour, while the final operations of the former can be carried out by machinery.

In Norfolk, it is said that farmers are pressing further than ever the use of machinery in various ways, while in Kent it is stated that hops are being grubbed up, partly because they require so much labour in the later stages, and partly because it is thought that the beer tax will curtail the demand for hops. In some cases it is actually stated that land is going out of cultivation altogether for want of labour.

In certain counties the lack of temporary casual labour for threshing has meant that the permanent hands have been recently put on to do this work, so that some agricultural operations of the farm have fallen behindhand. This lack of casual labour foreshadows serious difficulties in the hopping and fruit-growing counties in the spring and early summer.

In this connection it may be observed that in the counties which rely on the annual migration of Irish labour, and in particular in Cheshire and Lancashire, farmers are apprehensive that the ordinary influx will not occur this year in as large a volume as usual. The number of Irish migratory labourers has been rapidly dwindling in recent years, and this year there will be many alternative openings for labourers who normally come to this country, and even a shortage in Ireland itself, for it is estimated that over 30,000 men have been called up or have enlisted from those employed in agriculture in Ireland. The more prosperous Ireland becomes the less ready are the labourers of Connaught to spend the summer working in the English counties; but the high rate of wages for temporary labour that is likely to prevail may be sufficient to attract migration in as large a volume as usual.

AGRICULTURAL RETURNS OF THE UNITED KINGDOM,* 1914.

[APRIL

Acreage and Production of Crops.

Crops.	Acreage.		Produce.**		Yield per acre.		Average yield per acre of 10 years 1904-13.
	1914.	1913	1914.	1913.	1914.	1913.	
Total Area (excluding water)	Arres. 76,457,278		—		—		—
Total Acreage of Crops and Grass †	46,642,951	46,618,418	—		—		—
Arable Land	19,320,823	19,338,767	—		—		—
Permanent Grass—			Tons.	Tons.	Cwt.	Cwt.	Cwt.
For Hay	6,489,885	6,798,877	8,192,555	10,164,048	25'25	29'90	28'85
Not for Hay	20,832,243	20,480,804	—		—		—
Total.. ..	27,322,128	27,279,681	—		—		—
Wheat	1,604,932	1,790,376	Quarters. 7,804,041	Quarters. 7,087,030	Bshls. 32'77	Bshls. 31'67	Bshls. 31'88
Barley or Bere	1,871,169	1,930,652	8,605,678	8,204,066	34'48	34'01	34'03
Oats	3,877,564	3,661,479	20,663,537	20,660,279	42'63	41'72	41'94
Rye	66,783	63,419	—		—		—
Beans †	301,325	275,511	1,120,078	950,309	30'72	28'60	29'85
Peas †	169,804	164,968	374,038	423,255	23'02	26'41	26'60
Potatoes	1,197,008	1,173,418	7,476,458	7,664,804	6'25	6'48	5'54
Turnips and Swedes	1,752,574	1,762,130	24,105,753	25,313,818	13'83	14'40	14'66
Mangold	515,804	500,209	9,522,921	9,276,129	18'30	18'54	19'42
Cabbage, Kohl-rabi and Rape	191,343	188,410	—		—		—
Vetches or Tares †	137,447	114,399	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
Hops	36,661	35,676	507,258	255,641	13'84	7'17	8'94
Small Fruit †	100,719	99,726	—		—		—
Clover and Rotation Grasses—			Tons.	Tons.	—		—
For Hay	2,902,902	3,025,345	4,210,024	5,231,040	29'01	34'58	32'49
Not for Hay	3,659,688	3,674,636	—		—		—
Total.. ..	6,562,590	6,599,981	—		—		—
Other Crops	286,625	282,923	—		—		—
Bare Fallow	347,965	306,140	—		—		—

Live Stock.

	1914.	1913.
Horses used for Agricultural Purposes (including Mares kept for breeding)	No. 1,320,466	No. 1,333,155
Unbroken Horses including Stallions	One year and above 359,362	358,504
Under one year	171,749	174,680
Total Horses	1,842,557	1,865,745
Cows and Heifers in Milk or in Calf	4,576,852	4,300,611
Other Cattle	Two years and above 2,326,584	2,479,753
One year and under two	2,587,853	2,571,767
Under one year	2,653,274	2,544,347
Total Cattle	12,144,563	11,896,470
Ewes kept for breeding	11,221,504	11,025,059
Other Sheep	One year and above 5,937,911	5,349,433
Under one year	11,626,580	11,177,647
Total Sheep	27,886,095	27,552,139
Sows kept for breeding	492,981	400,970
Other Pigs	3,446,906	2,893,237
Total Pigs	3,939,887	3,294,207

* Exclusive of the Isle of Man and Channel Islands where no produce statistics are collected.

** The figures of Produce for Ireland are subject to revision.

† Exclusive of Mountain and Heath land used for grazing.

‡ Figures include acreage but not produce of areas picked or cut green, except in the case of beans in Scotland, where the acreage picked or cut green is excluded.

§ Figures for Scotland include Beans, Mashum, &c., for fodder.

¶ Figures for Ireland include Orchards.

THE *Bulletin of Agricultural and Commercial Statistics* for March, 1915, gives figures which may be taken to represent the world's

**Notes on Crop
Prospects Abroad.**

production of cereals in the harvest year 1914-15. The countries included are Germany, Austria, Hungary, Belgium, Bulgaria, Denmark, Spain, France, Great Britain and Ireland, Italy, Luxemburg, Norway, Netherlands, Rumania, Russia in Europe, Sweden, Switzerland, Canada, United States, India, Japan, Russia in Asia, Algeria, Egypt, Tunis, Argentina, Chile, Australia, and New Zealand.

Wheat.—The total production in the above-mentioned countries amounted to 460,900,000 qr. against 501,520,000 qr. in 1913-14, or a decrease of 8.1 per cent. The production, however, was greater by 0.7 per cent. than the average production of the five preceding years, and by 7.5 per cent. than the average of the 10 preceding years.

Rye.—The production in the above countries, excluding Great Britain, India, Japan, Algeria, Egypt, Tunis, Chile, Australia, and New Zealand, is placed at 203,159,000 qr. against 218,013,000 qr. in 1913-14, or a decrease of 6.8 per cent. It was also smaller by 0.4 per cent. than the average of the five preceding years, but greater than the average of the 10 preceding years by 3.5 per cent.

Barley.—For the same group of countries, with the exception of India, Chile, and Australia, the production is estimated at 168,293,000 qr. in 1914-15 against 193,168,000 qr. in the previous harvest year, or a reduction of 13 per cent. It was also smaller by 5 per cent. than the average of the 5 preceding years, but greater by 2.6 per cent. than the average of the 10 preceding years.

Oats.—For the same countries as aforementioned, omitting India, Egypt, Chile, and Australia, the total production is placed at 441,600,000 qr. against 490,330,000 qr. in 1913-14, or a diminution of 9.9 per cent. It was also smaller than the average of the five preceding years by 2.7 per cent., but greater than the average of the 10 preceding years by 6.2 per cent.

India.—The preliminary estimate of the wheat crop places the production at 48,986,000 qr. in 1914-15, against 39,315,000 qr. in 1913-14, or an increase of 24.6 per cent., while the area cultivated was also greater by 23 per cent.

Sowing of winter cereals.—The areas estimated to have been sown to cereals in 1914-15, compared with the areas sown during the corresponding period of 1913-14, expressed as percentages, are as follows:—*Wheat.*—Denmark, 103; Great Britain, 110; Italy, 105; Luxemburg, 107; Rumania, 92; Switzerland, 110; Canada, 109; United States, 111; Japan, 99. *Rye.*—Denmark, 93; Luxemburg, 106; Rumania, 76; Switzerland, 110; United States, 103. *Barley.*—Rumania, 71; Switzerland, 105; Japan, 102.

France.—The official report on the condition of the crops in France on 1st March is as follows:—Winter wheat 68 as compared with 71 in 1914, rye 72 against 73, winter barley 69 against 69, and winter oats 70 against 66 in 1914 (100 = very good, 80 = good, 60 = fairly good) (*London Grain, Seed and Oil Reporter*, 24th March.)

Russia.—The Department of Rural Economy and Household Statistics, on the basis of upwards of 7,000 communications from growers, have come to the following conclusion relative to the influence of the weather (to the 23rd February) on the condition of winter sowings in European Russia: Notwithstanding the fact that the winter set in generally late, and that up to the middle of December the winter plants, especially in the Black Soil region, remained with poor snow

cover, they were, nevertheless, unharmed practically everywhere as the frosts at this period did not exceed 20 to 24 degrees Fah., and were not continuous. The rather keen frosts experienced later on in December did not harm the sowings, as these were now already under snow. Only the appearance of an ice crust, after the January thaw, gave cause for fear; however, trustworthy indications of the possibility of damage to the plants at this period of the winter are almost always absent. One factor which might bring about extensive damage to the sowings is the very wet state of the soil, as, in consequence of the swift melting of the snow at the time of strong and protracted thaws in January and February, the low-lying fields appeared to be inundated with water. Field mice also threatened damage in parts of New Russia and Caucasia, the vermin being numerous. (*Broomhall's Corn Trade News*, 18th March.)

Australia.—The latest official estimate of the wheat harvest in the six Australian States gives the yield at a little more than 29½ million bushels, as compared with 108 million bushels in 1913, and 96 million bushels in 1912. (*London Grain, Seed and Oil Reporter*, 11th March.)

South Africa.—According to information received at the office of H.M. Trade Commissioner for South Africa from the Commissioner of Customs and Excise at Pretoria, a good maize crop all over the Union is anticipated. In Natal it is expected that the crop will constitute a record for the past 20 years, and that there will be a surplus of 2,000,000 bags for export. In the Orange River Colony also a record is expected, some estimates placing it as high as 3,000,000 bags, three-fourths of which will be available for export. (*Board of Trade Journal*, 25th March.)

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales, state that the drier weather prevailing over most of the country during March, especially in the latter half of the month, has effected some improvement in agricultural conditions. Winter beans and oats are generally doing well.

Very variable progress has been made with spring sowing. In the south, good progress was made, especially on light land, during the latter half of the month, although the season is still in this respect a backward one, except perhaps in the extreme south-western counties. In the north, where the weather was more stormy, less progress had been made. In most districts the young crops are not yet showing, but where they are up they look quite well.

Potato planting was being pushed forward towards the end of the month in the fen districts of Lincoln, and Norfolk, and a beginning had been made in Lancashire and Cheshire, but it was checked by the frosts at the end of the month. Otherwise but little had been done, except with the earliest kinds.

Seeds are generally vigorous and satisfactory in the north and west, but in the south they are generally a much thinner plant, although healthy; in the midlands they are variable.

Ewes are generally in poor condition after the trying winter. The fall of lambs has generally been about average, but hardly more, and in the later northern flocks results are rather poor, a somewhat considerable mortality among ewes or lambs being reported from various localities in this part of England. In the south the health of the flocks is generally more satisfactory, and the strength of the lambs materially improved during the latter part of the month.

Particulars with regard to wheat and the supply of agricultural labour are given in the last full page of the report.

ACCORDING to statements published in the Board's Monthly Agricultural Report for 1st April, 1915, early-sown wheat on that date was looking well on light land, but in many districts wheat on heavy land and also late-sown autumn wheat on light land was backward and had lost colour. The total area under wheat is about 10 per cent. greater than last year. The following are the particulars for the various districts:—

Northumberland, Durham, Cumberland, and Westmorland.—Where sown early on dry land autumn-sown wheat was generally satisfactory, but that sown late, or on heavy wet land, was weak, and of a bad colour. The area under wheat is probably about one-tenth greater than last year on the whole. Some spring wheat had been got in.

Lancashire and Cheshire.—Autumn-sown wheat, on the whole, looked fairly well, though backward in some districts; that late sown was weak and patchy, however, and a few crops, on land which has been waterlogged, will be ploughed up. There is about 10 per cent. more land under wheat than a year ago.

Yorkshire—Autumn-sown wheat varied considerably, the early sown on dry land looked well, but on heavy land, or where late sown, the crop was thin and backward, and of a bad colour, and a few fields had been ploughed up. The area is probably rather more than 5 per cent. above that of 1914.

Shropshire and Stafford.—Winter wheat on the heavy lands was thin and backward, and frequently of a poor colour, though on drier soils its condition was about average. The area is about 10 per cent. greater than last season.

Derby, Nottingham, Leicester, and Rutland.—On the dry lands autumn-sown wheat was, on the whole, healthy. On the low-lying or heavy lands the plant looked starved. The area is about one-tenth greater than a year ago.

Lincoln and Norfolk.—In north Lincolnshire autumn-sown wheat was weak and backward, but elsewhere in the county the crops looked well, except on cold wet land, where it was of a bad colour. In Norfolk the crop was not so good, and, except for some of the early sown, it was generally thin and backward. The area is about one-tenth greater than last year.

Suffolk, Cambridge and Huntingdon.—The late-sown autumn wheat and that on heavy and low-lying land showed signs of damage from the wet and some had turned yellow. Wheat on light soils, particularly if early sown, was doing much better; the acreage is about 10 per cent. greater than last year.

Bedford, Northampton and Warwick.—On light land, autumn-sown wheat looked well, but on heavy soils it was backward and had lost colour. The area sown is from 5 to 10 per cent. greater than last year.

Buckingham, Oxford and Berkshire.—Autumn-sown wheat was looking fairly well except on heavy or flooded lands, where it was thin and backward, and occasionally yellow. The area is about 10 per cent. greater than last year.

Worcester, Hereford and Gloucester.—Early-sown autumn wheat generally looked promising and was of a good colour, but the late-sown on heavy lands was rather thin and backward. The area is about 10 per cent. above that of last season.

Cornwall, Devon and Somerset.—Early-sown autumn wheat was

generally healthy, but later sown and that on heavy land was backward. The area is about 10 per cent. above that of last season.

Dorset, Wiltshire and Hampshire.—The appearance of autumn-sown wheat was improved by the drier weather; the later-sown, though still somewhat backward, is improving. The area is about 10 per cent. greater than last year.

Surrey, Kent and Sussex.—Autumn-sown wheat was backward. There was a good healthy plant on the lighter land, but on heavy soils the crop was often thin and of a bad colour. On the whole, about one-eighth more land is under wheat than a year ago.

Essex, Hertford and Middlesex.—In Essex and parts of Hertfordshire a good deal of the autumn-sown wheat was yellow and backward, especially on heavy land or where sown late. The area is probably about 5 per cent. greater than last year.

North Wales.—Autumn-sown wheat was generally strong and healthy, but was checked by frosts towards the end of March; where sown late or on heavy land, however, the crop had lost colour. The area is probably greater by nearly a fifth than last year.

Mid-Wales.—Where sown late or on low-lying heavy land, autumn-sown wheat was weak and thin; that sown early on dry land, however, was a promising plant. The area is about one-eighth greater than that of last year.

South Wales.—Late-sown autumn wheat and that on heavy soils was backward and had in many instances turned yellow. The acreage is nearly 10 per cent. greater than last year.

ACCORDING to statements in the Board's Monthly Agricultural Report (1st March) the supply of labour was deficient practically everywhere, although wages showed a rising tendency, temporary hands being particularly difficult to obtain.

Agricultural Labour in England and Wales during March. The following local summaries give further details regarding agricultural labour in the different districts of England and Wales:—

Northumberland, Durham, Cumberland and Westmorland.—The supply of labour was deficient throughout this division.

Lancashire and Cheshire.—In a few districts the supply of labour was sufficient for requirements during March, but generally there was a scarcity of workers, and sometimes the supply was very deficient.

Yorkshire.—There was a decided shortage in the supply of labour throughout the division, horsemen and milkers were very scarce, and fears were expressed lest temporary labour for potato planting should not be forthcoming.

Shropshire and Stafford.—Labour was everywhere very scarce, particularly for temporary work. Wages continued to rise.

Derby, Nottingham, Leicester and Rutland.—A general deficiency in the supply of labour was making itself felt. Notwithstanding the payment of higher wages, it was hardly possible to obtain sufficient labour.

Lincoln and Norfolk.—The supply of labour was short throughout the division, temporary labour was difficult to obtain, and a scarcity of horsemen was being seriously felt in parts of Lincolnshire.

Suffolk, Cambridge and Huntingdon.—Labour was short generally, but in Suffolk the shortage was not seriously felt as not very much farm work was possible.

Bedford, Northampton and Warwick.—Labour was very short throughout the district and temporary help was very difficult to get. Wages increased generally.

Buckingham, Oxford and Berkshire.—The shortage of labour, specially skilled, continued throughout the district and hampered the progress of spring cultivation.

Worcester, Hereford and Gloucester.—Labour was very short in all districts, and some further increases of wages were reported.

Cornwall, Devon and Somerset.—A shortage in the supply of permanent and temporary labour was reported throughout the division, and, with the increase in farm work, the deficiency was being felt. Advances in wages were made generally.

Dorset, Wiltshire and Hampshire.—Labour was scarce, and the shortage was being increasingly felt owing to the favourable weather conditions. Temporary labour for potato planting was very difficult to obtain.

Surrey, Kent and Sussex.—In west Sussex and in west and mid-kent, although there was a short supply of labour, the deficiency was not seriously felt. In most parts of Surrey, and in the east of Kent and east Sussex, the supply was, however, very short.

Essex, Hertford and Middlesex.—The supply of labour was short everywhere; temporary labour was very hard to get, in spite of higher wages.

North Wales.—In Anglesey the supply of labour was generally sufficient for requirements, although temporary labour was getting more difficult to obtain. Elsewhere the supply was, as a rule, deficient.

Mid-Wales.—The supply of labour was very short in Montgomery and parts of Radnor. In north Cardigan a scarcity of workers was being much felt, but in other parts of Cardigan and in Brecon there was a fairly satisfactory supply. Wages were raised by 1s. to 2s. a week in Radnor and Brecon.

South Wales.—There was a general shortage of labour in all but one or two districts, and in many instances wages were raised.

**Prevalence of
Animal Diseases
on the Continent.**

THE following statement shows that according to the information in the possession of the Board on 1st April, 1915, certain diseases of animals existed in the countries specified:—

Denmark (month of February).

Anthrax, Foot-and-Mouth Disease (181 outbreaks), Glanders and Farcy, Swine Erysipelas, Swine Fever.

France (for the period February 21st—March 6th).

Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox.

Holland (month of February).

Anthrax, Foot-and-Mouth Disease (88 outbreaks), Foot-rot, Swine Erysipelas.

Italy (for the period March 8th—14th).

Anthrax, Blackleg, Foot-and-Mouth Disease (232 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever, Tuberculosis.

Norway (month of February).

Anthrax, Blackleg.

Rumania (for the period December 29th—January 6th).

Foot-and-Mouth Disease (122 animals), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Russia (month of November).

Anthrax, Foot-and-Mouth Disease (48,863 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of December).

Anthrax, Blackleg, Dourine, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of February).

Anthrax, Blackleg, Swine Erysipelas.

Switzerland (for the period March 15th—21st).

Anthrax, Blackleg, Foot-and-Mouth Disease (83 "étables" entailing 1,192 animals, of which 11 "étables" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries:—Austria, Belgium, Bulgaria, Germany, Hungary, Montenegro, Serbia.

The Weather in England during March.

District.	Temperature.			Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.	
<i>Week ending Mar. 6th :</i>	°F.	°F.	In.	Mm.*	Mm.*	Hours.	Hours.	
England, N.E. ...	42·4	+3·7	0·35	9	0	5	2·7	—0·3
England, E. ...	43·7	+4·9	0·59	15	+6	5	3·1	0·0
Midland Counties ...	43·9	+5·1	0·47	12	+1	4	2·7	0·0
England, S.E. ...	44·3	+4·3	0·41	10	—2	4	2·8	—0·3
England, N.W. ...	42·9	+3·4	0·84	21	+7	6	1·4	—1·4
England, S.W. ...	44·2	+3·2	0·66	17	—1	5	2·4	—0·8
English Channel ...	46·3	+2·5	0·26	7	—8	4	3·5	—0·1
<i>Week ending Mar. 13th :</i>								
England, N.E. ...	42·1	+2·6	0·19	5	—6	3	2·5	—0·9
England, E. ...	41·2	+1·6	0·14	4	—5	3	1·8	—1·6
Midland Counties ...	41·2	+1·5	0·10	3	—8	2	2·1	—1·0
England, S.E. ...	41·8	+1·0	0·12	3	—8	3	1·9	—1·5
England, N.W. ...	41·7	+1·6	0·16	4	—10	2	2·8	—0·2
England, S.W. ...	41·6	+0·1	0·13	3	—14	2	3·2	—0·2
English Channel ...	44·3	+0·1	0·17	4	—11	3	2·5	—1·7
<i>Week ending Mar. 20th :</i>								
England, N.E. ...	41·1	+0·4	0·60	15	+4	3	4·3	+0·3
England, E. ...	40·5	—0·4	0·28	7	—1	2	2·2	—1·8
Midland Counties ...	40·9	—0·1	0·13	3	—6	2	3·4	—0·1
England, S.E. ...	41·7	—0·3	0·02	1	—9	1	2·6	—1·2
England, N.W. ...	41·1	—0·1	0·31	8	—5	4	3·2	—0·1
England S.W. ...	41·6	—0·9	0·02	1	—13	1	4·2	+0·3
English Channel ...	44·2	—0·9	0·00	0	—12	0	4·1	—0·7
<i>Week ending Mar. 27th :</i>								
England, N.E. ...	41·4	+0·1	0·39	10	+1	5	5·0	+0·7
England, E. ...	42·1	+0·3	0·55	14	+5	5	4·2	+0·1
Midland Counties ...	40·9	—0·9	0·46	12	+3	4	4·0	+0·1
England, S.E. ...	42·6	—0·3	0·34	9	—1	3	3·6	—0·6
England, N.W. ...	41·8	—0·1	0·31	8	—5	3	5·3	+1·5
England, S.W. ...	42·2	—1·1	0·48	12	—3	3	4·0	—0·4
English Channel ...	45·4	—0·3	0·37	9	—3	4	3·1	—2·1

* 1 inch = 25·4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked
or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	53	76	208	243
Animals attacked	53	81	223	261
Foot-and-Mouth Disease:—				
Outbreaks	—	6	—	11
Animals attacked	—	43	—	74
Glanders (including Farcy):—				
Outbreaks	—	7	7	26
Animals attacked	—	23	11	70
Sheep-Scab:—				
Outbreaks	27	18	134	134
Swine Fever:—				
Outbreaks	256	294	948	781
Swine Slaughtered as diseased or exposed to infection ...	1,131	2,763	3,973	7,278

IRELAND.

(From the Returns of the Department of Agriculture and
Technical Instruction for Ireland.)

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	1	—	1	—
Animals attacked	1	—	1	—
Foot-and-Mouth Disease:—				
Outbreaks	—	50	—	52
Animals attacked	—	683	—	711
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	3	4	13	20
Sheep-Scab:—				
Outbreaks	44	70	175	258
Swine Fever:—				
Outbreaks	26	27	65	61
Swine Slaughtered as diseased or exposed to infection ...	160	93	408	317

Unit Prices of
Artificial Manures.Statement of cost to the purchaser of 1 per
cent. per ton of Nitrogen, Soluble and In-
soluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d.	s. d.	s. d.	s. d.
Nitrogen from:				
Sulphate of Ammonia pure ... 195½%	14 9	14 0	—	14 0
Calcium Cyanamide ... 193½%	—	—	14 2½	13 11
Nitrate of Soda pure ... 195½%	12 11	—	—	11 11
Nitrate of Lime ... 190%	—	—	15 4	—
Nitrate of Lime ... 190%	16 6½	16 0	15 4	15 6
Nitrate of Lime ... 190%	—	—	15 4	15 3½
Soluble Phosphates from:				
Superphosphate 35%	2 4	2 0	2 4	2 2½
" 33%	2 4½	—	2 4½	2 2½
" 30%	2 5½	2 2	2 6	2 3½
" 26%	2 8½	2 4	2 8½	2 6
Dissolved Bones ... 3 7	3 7	3 6	3 4½	3 5½
Allowed for Nitrogen	19 6	19 1½	18 7½	17 10½
Allowed for Insol. Phos.	1 9	1 3½	1 8	1 7
Insoluble Phosphates (Citric Soluble) from:				
Basic Slag ... 1 10	1 10	—	—	—
Insoluble Phosphates from:				
Basic Slag ... 1 7	—	—	1 4	1 3½
Bone Meal ... 1 7	—	—	1 5	1 5
Allowed for Nitrogen	17 9	—	15 11½	16 14
Steamed Bone Flour ... 1 6	—	—	1 5½	1 5
Allowed for Nitrogen	16 10½	—	16 3½	16 4½
Potash from:				
Kainit ... —	—	—	—	—
Sulphate of Potash ... —	—	—	—	—
Muriate of Potash ... —	—	—	—	—
Potash Salts ... —	—	—	—	—

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the

various sources, at certain ports and Manufacturing Centres, for April, 1915.

Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
—	—	14 6	13 10½	—	—
14 2	14 8	14 8	—	14 3	15 2½
—	11 9½	—	—	—	12 8
15 8	14 6	14 8	—	15 2	14 10
—	—	—	15 11	15 8	15 4
—	—	—	—	15 10	—
2 2½	2 2	2 1	2 5½	2 5½	2 5½
2 3	2 2	2 1	2 6½	2 6½	2 6½
2 3½	2 2½	2 1½	2 7½	2 7½	2 7½
2 6	2 5	2 3½	2 10½	2 10½	2 10½
3 4	3 6½	3 6	3 10½	3 11½	4 0½
18 3	19 5	19 3	21 1½	21 3½	22 1½
1 7½	1 9	1 8½	1 11	1 11	1 11½
—	1 6½	—	—	1 11	—
—	1 3½	—	—	—	—
1 9	1 5½	1 0	1 4½	1 4½	1 6
14 8½	16 6	16 11	15 3	15 5½	17 0½
1 7	—	—	1 3½	1 5	1 7½
17 8	—	—	14 4½	16 1½	18 4
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and rebagging the ingredients, bags, and loss of weight.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in March and February, 1915.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	MARCH.		FEBRUARY.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	10 11	10 5	10 9	10 5
Herefords	10 10	9 10	10 8	9 10
Shorthorns	10 9	9 11	10 7	9 9
Devons	11 0	10 0	10 8	9 9
Welsh Rants	10 7	9 7	10 6	9 4
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	11	9½	10	9½
Sheep:—				
Downs	11½	10½	10½	9½
Longwools	11	9½	10½	9
Cheviots	12½	11½	11	10
Blackfaced	11½	10½	10½	9½
Welsh	11	10½	10½	9½
Cross-breds	11½	10½	10½	9½
	per stone.*	per stone.*	per stone.*	per stone.*
	s. d.	s. d.	s. d.	s. d.
Pigs:—				
Bacon Pigs	9 0	8 6	8 5	7 11
Porkers	9 4	8 10	8 10	8 4
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	24 0	20 2	24 18	20 15
—Calvers	22 11	18 16	23 5	19 12
Other Breeds—In Milk ...	21 12	18 5	23 9	19 8
—Calvers	18 4	16 10	18 0	16 0
Calves for Rearing	2 13	2 2	2 15	2 3
Store Cattle:—				
Shorthorns—Yearlings ...	12 13	10 14	12 13	10 16
—Two-year-olds... ..	16 14	14 17	16 15	14 17
—Three year-olds ...	20 7	18 1	20 15	18 0
Herefords—Two-year-olds...	19 8	17 11	19 17	17 12
Devons— "	17 9	15 16	17 2	15 4
Welsh Rants— "	16 15	15 9	17 10	15 5
Store Sheep:—				
Hogs, Hoggets, Togs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	54 11	47 1	49 9	44 5
Store Pigs:—				
8 to 12 weeks old	21 7	16 0	20 3	15 7
12 to 16 weeks old	37 10	27 10	35 5	26 4

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in March, 1915.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	Quality.	Birming- ham.		Leeds.		Liver- pool.		Lon- don.		Man- chester.	
		per cwt.		per cwt.		per cwt.		per cwt.		per cwt.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BEEF:—											
English	1st	72	6	72	6	—	—	74	0	72	6
	2nd	68	0	70	0	—	—	70	6	68	0
Cow and Bull	1st	65	6	67	6	66	0	65	6	65	0
	2nd	58	6	59	6	61	0	60	0	59	6
Irish: Port Killed	1st	—	—	—	—	71	6	73	0	70	0
	2nd	—	—	—	—	67	0	60	0	60	6
Argentine Frozen— Hind Quarters	1st	63	0	62	6	62	0	61	6	62	0
Fore "	1st	59	0	59	6	58	0	57	6	58	6
Argentine Chilled— Hind Quarters	1st	63	0	63	0	62	0	64	0	61	6
Fore "	1st	57	0	57	6	57	6	57	0	57	0
Australian Frozen— Hind Quarters	1st	60	6	60	6	50	6	61	6	60	6
Fore "	1st	57	6	59	6	58	0	58	0	58	6
VEAL:—											
British	1st	81	0	83	6	91	0	80	6	85	0
	2nd	72	6	75	0	—	—	71	0	80	6
Foreign	1st	—	—	—	—	—	—	83	0	—	—
MUTTON:—											
Scotch	1st	88	0	—	—	95	0	91	0	96	0
	2nd	72	6	—	—	89	0	85	6	91	6
English	1st	50	6	87	0	—	—	85	6	91	0
	2nd	74	0	82	0	—	—	80	6	85	6
Irish: Port Killed	1st	70	6	—	—	87	6	—	—	84	0
	2nd	—	—	—	—	77	0	—	—	79	6
Argentine Frozen	1st	54	6	54	6	53	0	54	0	53	0
Australian "	1st	52	0	52	0	51	6	52	6	51	6
New Zealand "	1st	54	0	58	6	—	—	57	6	—	—
LAMB:—											
British	1st	104	6	115	0	112	0	113	0	107	0
	2nd	97	0	—	—	102	6	105	0	100	0
New Zealand	1st	73	0	71	0	73	6	75	0	74	0
Australian	1st	67	0	66	6	60	0	67	6	60	0
Argentine	1st	66	6	67	6	66	6	67	6	66	6
PORK:—											
British	1st	71	0	73	0	75	0	81	0	75	0
	2nd	74	0	67	6	70	0	70	0	71	0
Foreign	1st	—	—	—	—	—	—	78	0	—	—

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at
certain MARKETS in ENGLAND in March, 1915.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.
BUTTER:—						
British... ..	17 0	16 0	—	—	16 3	15 3
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	—	—	—	—	—	—
„ Factory	—	—	—	—	—	—
Danish... ..	—	—	145 0	143 0	143 0	139 6
French... ..	—	—	—	—	139 6	135 6
Russian	—	—	—	—	132 0	128 6
Australian	140 0	137 6	139 6	137 0	138 6	134 6
New Zealand	142 0	140 0	142 0	140 0	140 6	137 0
Argentine	139 6	137 0	138 0	136 0	136 6	133 0
CHEESE:—						
British—						
Cheddar	98 0	95 0	98 0	96 0	101 0	96 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	100 0	95 0	107 0	101 6
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	91 0	92 0	93 6	92 6	95 0	93 0
BACON:—						
Irish (Green)	85 0	80 0	84 6	79 0	86 0	82 0
Canadian (Green sides)	73 6	69 6	73 6	68 0	75 0	71 0
HAMS:—						
York (Dried or Smoked)	115 6	113 6	—	—	116 0	108 0
Irish (Dried or Smoked)	—	—	—	—	110 0	104 0
American (Green) (long cut)	66 0	62 0	64 6	61 6	66 0	62 6
EGGS:—						
	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British... ..	11 10	10 5	—	—	13 9	12 11
Irish	12 9	12 3	12 10	11 11	13 5	12 6
Danish... ..	—	—	—	—	15 0	12 10
POTATOES:—						
	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	105 0	95 0	85 0	—	100 6	89 6
Langworthy	101 0	91 0	100 0	95 0	106 0	100 0
Up-to-Date	99 0	87 6	83 6	76 6	104 0	93 6
HAY:—						
Clover	—	—	103 6	82 0	105 0	95 6
Meadow	—	—	—	—	95 6	87 0

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1913, 1914 and 1915.

Weeks ended (in 1915)	WHEAT.									BARLEY.									OATS.								
	1913.			1914.			1915.			1913.			1914.			1915.			1913.			1914.			1915.		
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.	
Jan. 2...	30	5	31	1	44	4	28	6	26	2	29	10	19	10	18	2	26	6	19	10	18	2	26	6	19	10	
" 9...	30	3	30	11	46	2	28	4	25	11	29	7	19	2	18	4	26	5	19	4	18	6	27	6	19	4	
" 16...	30	5	31	0	48	9	28	6	26	0	30	5	19	4	18	6	27	6	19	4	18	11	28	10	19	4	
" 23...	30	11	30	11	51	6	28	10	26	3	31	3	19	4	18	11	28	10	19	4	18	11	28	10	19	4	
" 30...	31	1	31	1	52	8	28	11	26	6	32	5	20	2	19	1	29	10	19	4	18	11	28	10	19	4	
Feb. 6...	31	0	31	0	53	3	28	10	26	7	33	7	20	1	18	9	30	3	20	1	18	9	30	3	20	1	
" 13...	30	9	31	0	54	8	29	1	26	7	34	7	20	2	18	11	31	5	20	2	18	11	31	5	20	2	
" 20...	30	11	31	0	56	0	28	8	26	7	34	11	20	7	18	11	31	8	20	7	18	11	31	8	20	7	
" 27...	31	0	31	0	56	0	28	6	26	6	35	3	20	4	18	11	31	8	20	4	18	11	31	8	20	4	
Mar. 6...	31	3	31	5	55	11	28	5	26	2	34	6	20	0	18	9	31	8	20	0	18	9	31	8	20	0	
" 13...	31	1	31	6	54	8	27	11	26	0	33	5	20	2	18	7	31	0	20	2	18	7	31	0	20	2	
" 20...	31	1	31	5	53	9	28	6	25	8	32	2	19	11	18	6	30	7	19	11	18	6	30	7	19	11	
" 27...	31	3	31	4	54	3	27	6	25	7	31	11	19	7	18	8	30	6	19	7	18	8	30	6	19	7	
Apr. 3...	31	4	31	6	54	6	27	0	25	6	31	9	19	2	18	5	30	6	19	2	18	5	30	6	19	2	
" 10...	31	3	31	5			27	8	26	8			19	2	18	4			19	2	18	4			19	2	
" 17...	31	6	31	7			26	11	25	4			18	10	18	4			18	10	18	4			18	10	
" 24...	31	8	31	9			26	7	26	6			19	3	18	5			19	3	18	5			19	3	
May 1...	32	2	31	9			25	11	26	0			19	6	18	5			19	6	18	5			19	6	
" 8...	32	6	32	2			25	9	25	6			19	6	18	9			19	6	18	9			19	6	
" 15...	32	10	32	7			25	4	26	3			19	9	18	11			19	9	18	11			19	9	
" 22...	32	10	33	0			25	3	25	10			19	11	19	0			19	11	19	0			19	11	
" 29...	32	7	33	9			26	1	26	1			20	1	19	4			20	1	19	4			20	1	
June 5...	32	10	34	0			26	2	25	11			19	8	19	4			19	8	19	4			19	8	
" 12...	32	8	34	1			24	7	24	11			20	2	19	8			20	2	19	8			20	2	
" 19...	32	8	34	1			23	10	25	10			19	8	19	9			19	8	19	9			19	8	
" 26...	32	8	34	3			24	3	25	4			19	1	20	0			19	1	20	0			19	1	
July 3...	33	1	34	4			25	2	24	6			21	0	19	9			21	0	19	9			21	0	
" 10...	33	4	34	2			25	10	24	9			19	4	20	0			19	4	20	0			19	4	
" 17...	33	6	34	1			24	9	24	2			20	5	19	10			20	5	19	10			20	5	
" 24...	33	10	34	0			24	1	24	7			20	8	19	9			20	8	19	9			20	8	
" 31...	34	1	34	2			24	5	25	9			20	3	19	8			20	3	19	8			20	3	
Aug. 7...	34	1	34	9			24	9	25	2			19	0	19	1			19	0	19	1			19	0	
" 14...	34	3	40	3			24	7	29	4			18	7	25	1			18	7	25	1			18	7	
" 21...	33	7	38	9			26	5	29	10			18	8	24	3			18	8	24	3			18	8	
" 28...	32	7	36	2			29	0	30	3			17	10	23	5			17	10	23	5			17	10	
Sept. 4...	31	11	35	5			30	11	30	6			17	8	23	9			17	8	23	9			17	8	
" 11...	31	9	37	10			31	5	29	11			18	0	23	11			18	0	23	11			18	0	
" 18...	31	7	38	3			30	9	29	5			17	11	23	8			17	11	23	8			17	11	
" 25...	31	6	37	6			30	1	29	3			17	9	23	3			17	9	23	3			17	9	
Oct. 2...	31	3	37	1			29	9	29	1			17	10	22	9			17	10	22	9			17	10	
" 9...	31	0	36	8			29	1	28	10			17	10	22	5			17	10	22	5			17	10	
" 16...	30	11	36	7			28	8	28	8			17	9	22	4			17	9	22	4			17	9	
" 23...	30	7	37	2			28	7	28	7			18	0	22	5			18	0	22	5			18	0	
" 30...	30	1	37	10			28	2	28	3			17	9	21	7			17	9	21	7			17	9	
Nov. 6...	30	0	38	8			28	1	28	6			17	9	21	7			17	9	21	7			17	9	
" 13...	30	1	39	8			27	8	29	0			17	11	24	8			17	11	24	8			17	11	
" 20...	30	4	41	0			27	5	29	8			18	1	25	5			18	1	25	5			18	1	
" 27...	30	9	41	11			27	0	30	3			18	4	25	8			18	4	25	8			18	4	
Dec. 4...	31	2	42	2			26	8	30	2			18	4	25	9			18	4	25	9			18	4	
" 11...	31	2	42	1			26	5	29	11			18	6	25	9			18	6	25	9			18	6	
" 18...	31	2	42	7			25	11	29	8			18	5	25	9			18	5	25	9			18	5	
" 25...	31	0	43	3			25	10	29	0			18	4	25	11			18	4	25	11			18	4	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 50 lb. per Imperial Bushel.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of March, 1914 and 1915.

	WHEAT.		BARLEY.		OATS.	
	1914.	1915.	1914.	1915.	1914.	1915.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
London	32 5	56 5	24 10	33 0	19 4	32 6
Norwich	31 4	54 5	25 7	33 9	18 0	31 1
Peterborough	30 11	53 11	25 3	31 10	18 2	30 9
Lincoln	31 8	55 3	26 2	30 11	19 5	30 5
Doncaster	31 7	53 4	25 2	30 8	18 9	29 7
Salisbury	30 7	53 4	25 6	33 11	18 3	33 4

ADDITIONS TO THE LIBRARY.

Field Crops—

- Vermont Agricultural Experiment Station.*—Bull. 172 :—Place-Effect Influence on Seed Potatoes. (195+16 pp.) Burlington, Vt., 1914. [63.512(04).]
U.S. Department of Agriculture.—Bull. 182 :—Agricultural Alcohol : Studies of its Manufacture in Germany. (35 pp.) Washington, 1915. [663.5.]

Veterinary Science—

- Hindle, F.*—Flies in Relation to Disease : Bloodsucking Flies (398 pp.) Cambridge : University Press, 1914. 12s. 6d. net. [59.169(a).]
Herrick, G. W.—Insects injurious to the Household and annoying to Man. (4, 8 pp.) New York and London : The Macmillan Co., 1914. 7s. 6d. net. [59.169(c), 63.27(02).]
Imperial Department of Agriculture for the West Indies.—Pamphlet Series No. 77 :—Erysipelas (Epizootic Lymphangitis) and Husk or Hoose. (13 pp.) Bridgetown, Barbados, 1914. 2d. [619.1; 619.2.]
Mississippi Agricultural Experiment Station.—Tech. Bull. 5 :—Sero-Diagnosis of Pregnancy in Mares. (8 pp.) Agricultural College, Mississippi, 1914. [6.9.1.]
U.S. Department of Agriculture.—Bull. 106 :—The Granular Venereal Disease and Abortion in Cattle. (57 pp.) [619.2(a).] Bull. 131 :—Repellents for Protecting Animals from the Attacks of Flies. (20 pp.) Washington, 1914. [59.169.]
Vermont Agricultural Experiment Station.—Bull. 174 :—Methylene Blue : A Remedy for Infectious Abortion. (315-327 pp.) Burlington, Vt., 1913. [619.2(0).]
U.S. Department of Agriculture, Bureau of Animal Industry.—Order No. 211 :—Regulations governing the Meat Inspection of the United States Department of Agriculture. (97 pp.) Washington, 1914. [614.31.]
U.S. Department of Agriculture.—Bull. 166 :—Ophthalmic Mallein for the Diagnosis of Glanders. (11 pp. + I. plate.) Washington, 1914. [619.1(4).]

Economics—

- Co-operative Reference Library.*—Misc. Pubn. 2 :—Co-operative Mills and Bakeries. (50 pp.) Dublin : The Hinkett House, 1915. 6s. [331.6; 664.6.]
Central Translations Institute.—Russian Equivalent Tables. London : Danes Inn House, 265, Strand, W.C., 1915. 1s. net. [389.]

